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TABLE OF LEADING ARTICLES.

The Board of Water Supply of the City of New York. 195
The Improvement of Railroad Track................ 195
Cost Keeping 196
The Legal Responsibilities of Consulting Engineers.. 196
The Power Plant of the United Shoe Machinery Co. (Illustrated.) 198
Difficulties of Construction in an Outlet Sewer....... 203
Port Washington Water Works Under Air Pressure. (Illustrated.) 205
Sinking of a Railway Embankment.................. 206
Electric Locomotive of Metropolitan Underground Ry., London. (Illustrated.) 206
Anacostia Bridge, Washington—I. (Illustrated.)... 207
Steelwork of Marion Power Station, Public Service Corporation of New Jersey. (Illustrated.).......... 210
Pressure in City Water Works from Protective Viewpoint 212
Power Development of the Lewiston-Clarkston Co. (Illustrated.) 215
Causes of Crazing in Sewer Pipe.................. 216
Recent Municipal Work in Philadelphia............ 218
The Resistance of Bends and Elbows in Pipes........ 219
The Jungfrau Railway 221
Steam Turbines for Pumping Engines.............. 222
Properties of a Circle 222
The Manhattan Bridge 222

The Board of Water Supply of the City of New York.

The commission of three members to which is entrusted the work of selecting sources for, and constructing, an additional water supply for New York City, is known as the Board of Water Supply. It has taken the preliminary steps of organization with commendable promptness; its chief engineer and advisory board of three consulting engineers, together with a number of subordinates, are already appointed and at work. It has been announced that the new Board will adopt the principal findings of the former Commission on Additional Water Supply known as the Burr-Herring-Freeman Commission, as set forth in their report of 1903 and the supplementary report made in January of the current year. This also is a wise procedure and has the great merits of simplifying the situation and enabling the work of construction to be begun at the earliest practicable date.

It is obvious that all the surveys and investigations of the former Commission on Additional Water Supply may not be available for the present Board, as no investigation is ever entirely available in all its details for the subsequent work of construction, otherwise, indeed, it would not be a work of investigation. That Commission employed an engineering force of over 225 men during the greater part of a year and accumulated results of accurate surveys and other quantitative information which cannot fail to be of direct use in the work of the Board of Water Supply.

The good sense and practical directness with which the new Board has proceeded to the principal initial steps of its work augurs well for its future operations. Its duties must conserve the interests of probably the greatest municipal work ever undertaken, involving an expenditure ultimately reaching nearly 100 million dollars. The facing of such a great engineering enterprise, for that is precisely the character of the work undertaken by this board of three business men, may well cause them to reflect most seriously upon the duties which they have undertaken for the great community of which they are citizens. What may be termed the routine work of purchase, the administration of the Board's finances and the necessary accounting and reporting, while important in their way, are essentially every-day business matters. Absolute integrity and absolute freedom from politics are certainly required, but the great responsibilities attaching to the entire project of an additional water supply of 500 million gallons daily for the city are completely technical, and can be properly discharged only by the engineering organization of the Board. Under such circumstances it may be an open question whether the Chamber of Commerce of New York City was altogether right when it voted that business men only, presumably of the character of its own members, possess the qualifications requisite for membership of such a board. However that may be, the Board of Water Supply has assumed duties of the greatest weight and the public of New York City is deeply concerned in the manner in which they will discharge such duties.

The press of the city and public sentiment so far as indications may be observed highly commend the steps already taken by the Board in the direction of its work. This is a matter of special significance and special commendation, for the reason that the efficiency of the work to be done and the promptness with which well considered plans may be developed and put in process of construction depend almost wholly upon the principals in the engineering organization. Fortunately both the chief engineer and two members of the advisory board of consulting engineers are thoroughly familiar with the deficiencies of the present supply of the city and the measures necessary for securing a needed additional supply. Indeed, two members of the advisory board were members of the Commission on Additional Water Supply and are therefore intimately familiar with every detail of that work.

The city may, therefore, reasonably hope that effective relief from the present dangers of shortage of the water supply may be secured in the shortest possible time and in the most effective and economical manner. In the prosecution of its work, there are certain well established principles of administration that the Board will do well to keep continually before it. In the first place, obviously the administration of its affairs should be kept absolutely free from every possible suspicion of politics. Fortunately, the Mayor himself has indicated to the Board and to the public his approval of that feature of the matter in a most unqualified and emphatic way. In the next place, after having selected and appointed eminently satisfactory heads of the engineering organization, that organization should be strongly supported throughout its work but without any interference whatever with it. The engineering organization should be held closely responsible for results, but it should be accorded the widest latitude and the fullest authority to secure those results. Many a business man's commission has brought its work to grief by injecting its untrained engineering wisdom into the operations of a good technical organization. It is earnestly to be hoped that the Board of Water Supply, having begun this portion of its administration with such good judgment, will so discharge its duties in the future as to make the same wisdom and sound judgment characteristic of all its following operations.

There is an unprecedented opportunity, not only for the chief and other engineers of the new Board, but also for the members of the Board itself, to create a monumental public work for the service of what will probably soon become the greatest city in the world and it would be a public misfortune if mal-administration of any kind whatsoever should trench upon the attainment of that end.

The Improvement of Railroad Track.

A few years ago, during a discussion on bridge loading at a meeting of the American Society of Civil Engineers, there was considerable debate on the probable increase in weight of the steam locomotive, and it seemed to be the general opinion that about ten or fifteen per cent. was the utmost that was practicable, owing mainly to the standard clearances in tunnels and other structures. A careful consideration of the possible advent of heavy electric locomotives will indicate that this opinion may need modification provided the increase is not limited by the strength of the track. At the discussion in question, Mr. Swensson called attention to the fact that on one occasion when a very heavy train was run over a well-built road it was the track which suffered and not the bridges, and doubtless other engineers could give similar testimony if they desired.

There is a growing belief in this country that more attention must be paid to track construction. The steam locomotive has been brought to a high degree of efficiency, the electric locomotive is accomplishing remarkable results and is used to an extent which surprises those not previously acquainted with the numbers already manufactured for special purposes, bridges can be built to carry any loads, but the track does not seem to be materially better than it was twenty-five years ago, except for heavier rails. It is surprising that more accidents do not occur on some of the roads where tie renewals are considered an expensive luxury and track work is attended to by a low grade of laborers without responsible supervision. The number of heavy passenger trains sent at high speeds over poor track in this country is probably very great, and the comments on this feature of our railway practice by the foreign engineers who visited this country last spring were not at all flattering.

One very good reason exists for this condition. Locomotives have been developed as a commercial product and competition has tended to improve them. Bridges have always been under the charge of trained specialists, and their importance has been recognized because they were such prominent features of the roadway. But the track consists merely of rough timbers and rails which can be put together, in the opinion of the average man, without any more skill than is needed to drive spikes accurately. As a matter of fact, the money invested in ties is enormous and even from the mere financial point of view it is surprising that really scientific investigations of track improvements have not been undertaken long before this by some of the progressive American railways. Considerable good work has been done abroad, where the improvement of track is known to mean a great deal more than the preservative treatment of ties and the use of heavy rails and fastenings. But the investigations thus far undertaken are merely a scratching of the ground to be turned over deeply before definite data can be obtained, which will enable the engineer to decide just how strong a track can be made. No engineer will admit for a minute that the present dago-built structure is the best that can be produced. The factors that must be considered, resilience, strength, durability and the rest, are so many, however, that the problem has a complexity which is really very great and might well be delegated to such a joint committee of engineering organizations as is now working on the properties of concrete and reinforced concrete. It is so important that some such investigation ought to be undertaken at once, for safety in railway travel as well as the development of the weight of rolling stock urgently demand it.

Cost Keeping.

The presidential address delivered before the Society of Chemical Industry by Dr. William H. Nichols last month was on a most unusual and yet important topic for presentation before a technical association. It was the management of a chemical industrial organization, a subject of which the distinguished speaker has shown himself by his works to be a past master. On reflection it will be evident, however, that the discussion was one eminently appropriate for such an occasion. If there is any one trait conspicuously present in most successful men it is economy of energy and time, and this individual characteristic is nothing but what is called good management in the field of large affairs. For example, one of the most successful consulting specialists assumes that he has a certain number of working hours in the year, from which his income must be derived. He gives to this time a certain value per hour, and absolutely refuses to encroach on this time with any work which will not yield that amount in cash or its equivalent. His friends have learned better than to call for a chat during such hours and other people have to talk business or retire at such times. This management of a one-man business is the same in principle as that outlined by Dr. Nichols for a great industrial organization, and the same as that developed by the late Wm. P. Shinn at the Edgar Thompson Works, where a workman once complained that if he used a dozen more bricks in building a furnace the office at once detected the fact and demanded an explanation.

In reading Dr. Nichols' address the fact that appears at once is the underlying striving for economy which pervades the whole system of management he describes. The complex operating department controlling the work at a number of plants is organized with the idea of producing the goods desired by the selling department at the least cost. The construction department is striving to plan new works or improve old ones for the same purpose, the investigation department with its research laboratories is striving to ascertain the actual cost of all new subjects of a technical nature which come to the company's attention, but back of all is a statistical department which furnishes the information on which the success or failure of any part of the whole business is judged. This department advises the officers within a reasonable time after the end of each month of the cost of every product and step, the profit or loss on each article, and the total profit or loss of the company during the month. The results compiled by the statistical department of Dr. Nichols' company have been so exact that for several years the profits determined by public accountants at the end of the year have not varied one per cent. from those worked up in the statistical department month by month. To anybody who knows the arbitrary manner in which public accountants charge up some of the miscellaneous items in the business of a large corporation this result is little short of startling.

It is useful to call attention to this address by one of the leading chemists of the country at this time, because a considerable number of young men are now beginning their professional work and the matter of cost keeping may not seem very important to them. Dr. Nichols is merely one of a large number of successful men who have pointed out that it is essential for success, and the biographers of various captains of industry have repeatedly told about the solicitude for pennies shown by these eminent persons in their youth. There seems to be a feeling, however, that a technical man, usually working on a salary for a long time, does not need to take these precedents to heart. As a matter of fact, nothing could be wider from the truth, for technical men are particularly prone to waste their time, which is in one sense their capital. A man working in the average engineering office and getting two weeks' vacation is paid a cent and a quarter a minute for his working time when he receives a salary of about $1,500 a year. If he does not work full time he is practically taking so much money from his employer. If his time is worth a cent and a quarter to his employer, his spare time ought to be worth more to himself. The Engineering Record does not desire or intend to discuss such a subject as this at any length, although the importance of carrying backward into small things the underlying thought of Dr. Nichols' admirable address is most worthy of consideration by those who are ambitious of success in large affairs.

The Legal Responsibilities of Consulting Engineers.

In the editorial pages of "Engineering" there recently appeared a most interesting discussion of the legal responsibilities of consulting engineers for negligence. After an examination of English cases in which the skill of the engineer has been called in question and a perusal of the "General Digest" of American cases, enough cases could not be found in which members of the profession figured as defendants to enable any direct deductions to be made from judicial opinion. It was accordingly necessary to outline the subject from a consideration of the legal position of other classes of professional men, who have figured more frequently in court proceedings. Although this condition is most satisfactory, and, it is to be hoped, will continue for all time, it must be acknowledged that engineering has reached a professional status so recently that its practitioners have not had the time or the numbers to contribute in any large degree to the grist for judicial mills.

As for the rsponsibility of the engineer to display reasonable care in his work, the English law is summarized in Beven's "Law of Negligence" as follows: "The degree of skill requisite is such as may be expected in the circumstances of time and place from an average person in the profession, one neither specially gifted nor extraordinarily dull. Where this reasonable amount of information and skill proportioned to the duties that are undertaken is found, there is no liability for errors of judgment in the application of knowledge. Each case must depend on its own circumstances; with the paramount consideration that when an injury has been sustained that could not have arisen unless from the absence of reasonable skill or diligence, then there is liability." The English journal points out, however, that in the United States there seems to be a sharp distinction drawn between the general practitioner and the specialist. This is particularly true of the medical profession, but, it is said, it was also apparently held in some cases to be true of consulting engineers engaged to prepare estimates of the prices of work to be done. A search through such digests as are available in The Engineering Record's offices fails to brings to light any such decisions, but the view is in accordance with a number of recent expressions of opinion concerning the moral responsibility of the engineer as a judge of the equities of the relations between owner and contractor.

One aspect of the subject that is very important is the degree of responsibility of an engineer for the negligence of his employes. As a matter of elementary justice, there seems to be no question that a man is responsible for the work of all under him unless he protests in writing against this responsibility being put on him for reasons which he explains and would be considered valid by an impartial judge. The English journal referred to has been able to find no court decision on this subject relating to engineers, but it unearthed a pertinent one referring to a surgeon, who undertook a difficult operation without which the patient would have surely died. One of the surgeon's assistants, to whom was delegated certain important parts of the work, failed to perform it properly through an oversight or mistake. The verdict of the jury implied in effect that the surgeon was responsible for the fault of the assistant. This is the just view to take of the subject, for otherwise there would be no responsibility amounting to anything attaching to positions carrying with them the obligation of supervision of subordinates.

There is one feature of the law in England that has been settled by the courts which deserves special attention as showing the confirmation of a position taken in the correspondence columns of this paper by several engineers. An engineer employed to prepare estimates and other data for a bridge committee relied on borings taken some time before by a surveyor acting for the same committee. When the work was actually done the soil was discovered to be so bad that much deeper excavation was required than the engineer provided for and the cost far exceeded the estimates. The committee finally refused to pay the engineer for his work, owing to this mistake, and the court upheld them, saying: "If a surveyor delivers an estimate greatly below the sum at which a work can be done, and thereby induces a private person to undertake what he would not otherwise do, then I think he is not entitled to recover his fees." The same view was expressed by Lord Chief Justice Abbott as follows: "I think it is of great importance to the public that gentlemen in the situation of the plaintiff should know that if they make estimates and do not use all reasonable care to make themselves informed, they are not entitled to recover anything."

These decisions concerning the responsibility of professional men may not be applicable in the United States to engineers, except in a few cases, because of the nature of the different relations between the engineer and his client. If an engineer is engaged at a regular salary or its equivalent, it is not likely that he can be held responsible by his employer for any financial losses due to his negligence, nor can he be so held in case he is simply called upon to give advice on data presented to him, which he is not expected to verify. The only way in which such responsibility can be definitely fixed on the engineer, apparently, is by retaining him in a professional manner and putting upon him the duty of securing definitely stated results. Such a procedure will increase the engineering expenses of an undertaking, but, on the other hand, it will greatly decrease the probability of losses and delays through troubles with contractors claiming to have been misled by the inaccuracy of the data furnished by the engineer.

Notes and Comments.

The Last Wooden Bridge on the main line of the Philadelphia & Reading Ry. has been replaced lately by steel-riveted spans. It consisted of two through spans of 143 ft. and 158 ft. respectively, and was built south of Port Clinton in 1874. Shortly after erection it was covered with sheet iron which protected it from the weather so well that its strength has been impaired but little and its renewal was due mainly to its narrow width and lightness for present rolling stock.

The Shop Employees of the Crocker-Wheeler Co. have organized a beneficial association which has a number of novel features. Every employee who pays ten cents a week to the association will be entitled to $10 a week, for twenty weeks, during incapacity through illness. If he dies, his family will receive $100. The payment of twenty, thirty or forty cents a week entitles him to $15, $20 or $25, respectively, with death benefits of $150, $200 or $250. The company has offered to contribute an amount equal to the dues paid to the association. Thus if $6,000 are paid yearly in dues, the income of the association will be $12,000. The company does not require representation in the association, which will be run entirely by the employees.

Work on the Yuma Dam of the U. S. Reclamation Service is being pushed as rapidly as the floods in the river permit. The site is 12 miles up the Colorado River from Yuma in the desert country where the summer temperature rises to 120 deg. on the slightest provocation. Under such circumstances it is necessary to provide unusual luxuries for the men in order to keep them on the work. The contractors, J. G. White & Co., Inc., of New York, will equip their model camp with refrigerating apparatus and put in telephone and telegraph lines to Yuma, while a gasoline launch and a number of barges will furnish transportation facilities to that place. The contract requires the removal of about 300,000 cu. yd. of rock and 300,000 cu. yd. of earth, 30,000 cu. yd. of concrete, 50,000 lin. ft. of sheet piling and 80,000 cu. yd. of rubble paving.

The Fuel Value of Ashes from four typical boiler plants in New York, the mechanical plant of the Rogers building, the Edison Electric Light Co., the Hotel Berkeley and a large packing house where mechanical stokers are used, have been investigated by Messrs. H. Fay and F. W. Snow, of the Massachusetts Institute of Technology. The ashes, all from bituminous coal, were first screened into three classes of material, each of which was sampled by crushing and quartering. The samples were then mixed with a known amount of standard coal to promote combustion and tested in a Mahler bomb. The average percentage of unburned coal in each of the four ashes was 2.49, 19.2, 6.66 and 18.6, respectively. The average, 11.98, is considerably lower than that ordinarily assumed for New York ashes.

The International Navigation Congress will be opened at Milan on the morning of Sept. 25 at the Scala Theater and the first meetings of the various sections will be held in the afternoon of the same day. During the Congress excursions will be made to the Lake of Como, the Paderno hydro-electric plant, Lake Maggiore, the Vizzola hydro-electric plant, Genoa, Spezzia, Naples, the Po and Venice. The Italian government has made a reduction of 75 per cent. in railway fares for members of the Congress and many other special attentions will be paid to those who attend. It is hardly necessary to add that this is the tenth meeting of the Congress and that it is one of the most thoroughly useful organizations of its kind. Milan is a delightful place for a convention in September, and the Italian Lakes are then at their best and no farther from the city than the daily ride of many New York commuters.

The Experiments on Compression in steam engines conducted by Doerfel some time ago were so contrary to previous opinions deduced from theoretical data that they have been severely criticized. In order to throw further light on the subject H. Klemperer has conducted an elaborate investigation which he explains at much length in the "Zeitschrift" of the Society of German Engineers. The chief results obtained are as follows: (a) Compression is economical so long as during compression no condensation of the shut-off steam takes place. (b) The condition for economical compression is that the temperture of the steam at the end of the compression should not exceed the temperature of the walls. The economy of compression is unaffected by the duration of the compression, but depends only on the final compression reached. (c) Compression is uneconomical when the steam consumption increases in proportion to the increase of the ratio of the amount of compressed steam to the amount of fresh steam.

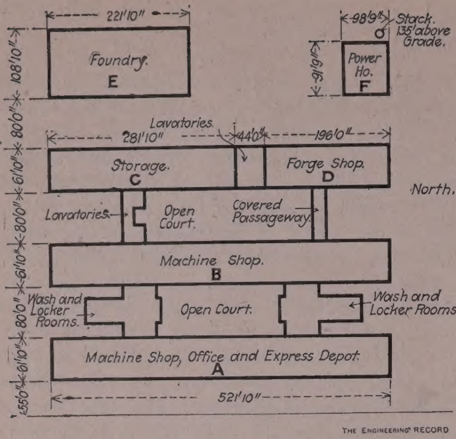
The Collapse of a Building in Albany, N. Y., used as a department store, affords another example of the necessity of exercising great care in all work of repairs. As nearly as can be ascertained at this writing, the failure was due to extensive underpinning operations below the portion of the building where the collapse started. One of the pillars or its foundation was so weakened that the entire vertical line of columns carried by it dropped and the floorbeams of four stories supported by it were allowed to fall. This initial collapse brought down all that part of the building. The failure occurred early in the morning when only a few customers were in the store and consequently the injuries and loss of life were not so serious as they might have been later in the day. In old buildings like this, while the timbers are often of ample size, their connections are of the most rudimentary nature, and no reconstruction can be undertaken with safety until these connections have been examined and the effect of small movements in them ascertained.

The Foreign Trade of the United States is now being investigated by the Department of Commerce and Labor in order to intelligently assist in its development. As a preliminary step it is compiling a comprehensive card index giving the name and address of as many American manufacturers as possible, the location of their branch establishments, a description of their product, their capital, the productive capacity of their works, where the product is now sold and all other information that is considered likely to be of value in promoting export relations. These data are being collected by the Bureau of Manufactures of the Department, and it is hoped that Congress will authorize furnishing duplicates of the index to all the principal consulates. Whether anything useful will come of the project depends largely on American manufacturers themselves, but it would seem that their cooperation to the limited extent of supplying the Bureau's request for information is an investment of a trifling amount of time well worth making.

A Discussion of Steam Turbines deserving careful consideration was read before the Franklin Institute recently by Prof. H. W. Spangler. His object was to formulate some equitable basis for the comparison of reciprocating engines and steam turbines, which, he states, should be the ratio of the output of the machine to the maximum amount of energy available between the conditions at steam admission and discharge. The development of this system by the author starts with Carnot's efficiency, which he terms E_1. The turbine, however, should only convert the energy E_3 into work, and the value of the theoretical conditions under which the turbine works is, therefore, $E_2 = E_3/E_1$. E_3 is the work theoretically obtained from 100 heat units supplied; the work actually obtained is indicated by E_5. Consequently the efficiency of the heat transformation $E_4 = E_5/E_3$. By tabulating the results of many turbine tests according to increasing values of E_5, and setting down the steam consumption per horse-power hour, it is found that the coal cost per horse-power may actually be less with the greater steam consumption.

Water Waste in Washington has at last had the serious results that have been predicted for years, and the residents are face to face with the absolute necessity of curtailing it. Unfortunately, there is a controversy as to the chief cause of waste, some influential parties holding that it is to be found in federal buildings while others state that it is in poor plumbing and street mains. The matter is so serious that The Engineering Record suggests the advisability of an investigation, by the pitometer method, of the actual facts. This has been done with highly advantageous results in many cities, large and small. It is not expensive and it determines accurately where the waste is. When the facts are definitely determined for the entire district, which should not take long, it will be possible to lay down a plan of waste prevention that will be entirely fair to everybody. But until the facts are determined in this way, or some other equally conclusive, it is useless to expect that any solution can be reached without resorting to measures that will be considered arbitrary and unwarranted by influential people.

The Road Improvements contemplated by a proposed amendment to the constitution of New York State are intended to expedite the development of the highways which has been going on rather slowly under existing laws. The latter were excellent as educational steps, but now that the value of good roads is appreciated they do not furnish the assistance needed. Last year the State raised $1,100,000 for such work. Under the proposed law the State may contract a debt which shall not at any time exceed $50,000,000. It is proposed during the next ten years to spend $50,000,000 on highway improvements, the State paying half of this sum. Interest at 3 per cent. and a 2 per cent. payment to the sinking fund will call for an annual draft on the State Treasurer, when all the bonds are issued, for $1,250,000, only $150,000 more than was raised last year. This project has been developed only after six years of study by the road supervisors and commissioners of the various counties at their conventions at Albany. The underlying purpose is to use the State's credit to increase the highway improvements without any appreciable increase in taxation, in the same way that merchants of every degree employ their credit. The project has decided merit. It has one defect, however, and that is the lack of remedy for the present deplorable waste of money in useless puttering under untrained local commissioners. The legislator who can stop this waste will be a public benefactor.



Plan of Buildings.

The Power Plant of the United Shoe Machinery Co.

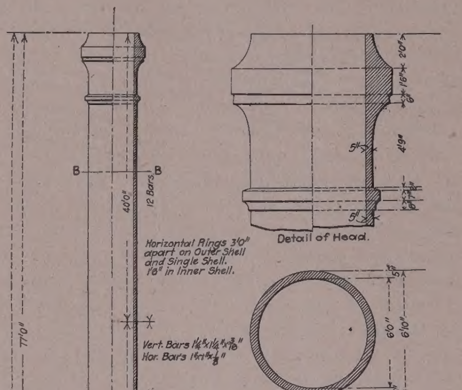
By Howard S. Knowlton.

The design and construction of the United Shoe Machinery Company's shops, at Beverly, Mass., formed the subjects of articles in this journal March 4, April 1, and April 8, 1905, with special reference to the use of reinforced concrete throughout the buildings. Since the latter date the power house installation has been rapidly pushed to the point where regular service is being supplied to the shop machinery, and the plant is now in shape to meet the developing requirements of the entire factory in the way of heat, light, power and water supply. Referring to the general plan of works, the various buildings shown have been given the following designations by the company: A, Machine Shop, Office and Express Dept.; B, Machine Shop; C, Storage; D, Forge Shop; E, Foundry; and F, Power House. The buildings run north and south, the power house being located in the northwest corner of the group. The designation north or south is used to specify a portion of any building under discussion; thus, A B N refers to the unit formed by the north ends of the two machine shop structures with their connection.

The power house is a one-story and basement concrete structure, 91¾ ft. by 98¾ ft. It is divided by a longitudinal partition wall into a boiler room 49 ft. and an engine room 39 ft. wide inside, the common length being 95 ft. The output of the power house is distributed among the various buildings by two reinforced concrete tunnels, 5 x 7 ft. in cross section. One of these runs east and west directly after leaving the power house; the other branches south to a point opposite the foundry, whence it turns and runs parallel with the former to building A. The tunnel lines comprise electric light and power cables, light and low pressure steam pipes for the operation of the elevator pumps and heating system, return from the latter, water supply and compressed air piping. The power house electrical generating equipment aggregates 1,000 kw. normal rating, and the electric wiring in the tunnels is run in vitrified clay conduit located beneath the pipe lines.

Boilers.—The boiler equipment consists of four 275 hp. Stirling water tube units, two of which are equipped with superheaters. The superheating boilers each contain 3166 sq. ft. of total heating surface and 26.25 sq. ft. of grate surface. Each of the other boilers has a total heating surface of 2750 sq. ft., and a grate surface of 56.25 sq. ft. A superheat of 150 degrees F. is readily obtained, and the shells are of double butt strap construction with triple riveted joints. An overload capacity of 30 per cent. is provided. The operating steam pressure now employed is 150 lb., but the boilers are guaranteed to run at 160 lb. if desired. Hand firing is employed, coal being brought to the plant in wagons. On the north side of the boiler room is installed a Sturtevant economizer having 3583 sq. ft. of heating surface. A bypass is provided so that the flue gases may be directly discharged into the chimney when desired. The draft is controlled by a Locke damper regulator.

The water supply of the plant may be drawn from either an upper or a lower reservoir which the company has built nearby, or from the city mains. Ordinarily, the upper reservoir is used for boiler feed and domestic purposes, and the lower one for the supply of condensing water. City water is at present used for drinking purposes and an auxiliary supply for the step bearings of the turbo-generators, which are installed in the engine room. Surface water drainage is discharged into Bass River, below the reservoirs, and the sewage of the shops into the Beverly sewerage system.



Details of Chimney

Stack.—One of the most interesting features of the plant is the chimney. The general features of this stack were described in this journal April 8, page 412, but some additional particulars are now available. The chimney was designed and built by the Weber Steel-Concrete Chimney Company, of Chicago, the construction work occupying 60 days. It is 141 ft. 1 in. high, including the foundation, and 6 ft. inside diameter. The foundation is 18 ft. square and 42 in. high, and is built of one part Portland cement, two parts sand and four parts crushed stone. The steel reinforcement consisting of a network of 1¼ in. by 1¼ in. by 3-16 in. steel T bars, placed horizontally. The vertical bars of the chimney are bent under the horizontal bars, in the foundation. The total weight of the foundation is 161,008 lb. and it is 12 ft. below grade. The earth weight upon it is 184,690 lb. The lower 60 ft. of the chimney consists of two shells with a 4 in. air space between them. The inner shell is 4 in. thick and the outer shell 6 in.; the air space is connected with the outside atmosphere, and the lower part by four small air inlets 3 in. by 5 in. each. Two sets of wooden forms were used, each set being 3 ft. high and made in sections. About 3 ft. per day were built on the double and 6 ft. on the single shell. A mixture of one part cement and three parts sand was used on the chimney.

In the outer shell of the first 27 ft. of the chimney there are 72 vertical bars of 1¼ in. by 1¼ in. by 3-16 in. steel T's placed in groups. In the inner shell there are 12 vertical bars, and there are horizontal rings of 1 in. by 1 in. by ⅛ in. T's every 18 ft. In the outer shell these rings are 3 ft. apart. The next 15 ft. of the stack have 60 vertical bars. Twelve bars are dropped in each length of 15 ft. after this. The total weight of steel in the stack is 14,441 lb. The stack is guaranteed to withstand a wind pressure of 50 lb per sq. ft. When the chimney was about half erected it was subjected to a storm in which the U. S. Weather Bureau record for the vicinity was 77 miles per hour. The only damage was the bending of a few of the vertical bars which projected above the cement at the top, which was fresh and but a few hours old. The total weight of the stack is 234,185 lb. The maximum pressure on the ground is two tons per sq. ft. The shell in the single portion is 5 in. thick, and the chimney is guaranteed to withstand a temperature not exceeding 1,500 degrees F.

Turbine Plant.—Most of the power house machinery is located in the engine room or basement beneath it. In the former is an electrical generating equipment consisting of two 500 kw. Curtis steam turbines, each direct-connected to a 4-pole, 600-volt, three-phase, 60-cycle alternator. The speed of each unit is 1800 r.p.m. and the steam pressure 150 lb. Each turbine is of the four-stage type and may be run condensing or non-condensing. The overload capacity is 50 per cent. for two hours. Each machine is equipped with a tachometer and an elctromagnetic emergency governor set at 1900 r.p.m. The condensing apparatus is located in the basement, which is built without a ceiling over that equipment, so that its operation can easily be seen from the engine room. Adjoining the turbines and mounted on concrete foundations close to the boiler room partion wall are two pumps for the step bearing water supply. Each of these pumps is a 4½-in. by 1½ in. by 4 in. duplex end-packed machine, built by the Platt Iron Works Company, of Dayton, Ohio. The pumps deliver the water at a pressure of about 800 lb. per sq. in. to a cylindrical reservoir mounted in the engine room which is partially filled with compressed air. Before passing to the step bearings the pressure is reduced by bafflers in the basement to about 200 lb. per sq. in. The reservoir acts as an accumulator, and will enable the turbines to be operated 4 minutes in case of a shut down in one of the pumps. Each pump has sufficient capacity to supply the two turbines.

The generator bearings are supplied with oil by two 2-in. by 1¼ in. by 2¾ in. Blake duplex pumps, which raise the oil from a receiving tank in the basement to a storage tank in the engine room, whence it flows into the bearings.

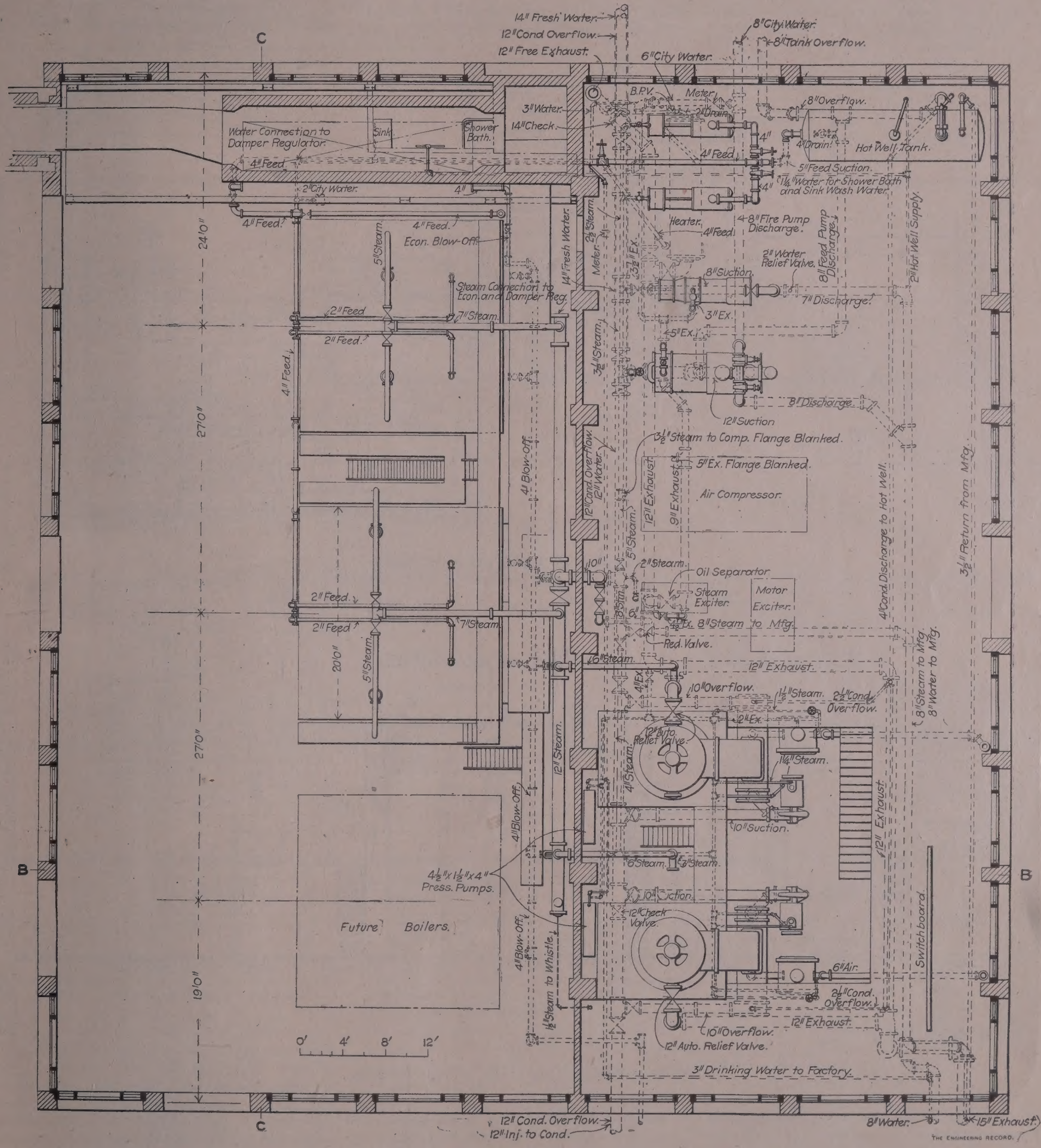
The turbine speed variation between no load and full load is guaranteed not to exceed 2 per cent., with a momentary variation of not over 4 per cent. The steam consumption of the turbines between half load and full load is to average not over 22.5 lb. There are two exciter sets in the engine room, one being motor driven and the other steam driven. The former consists of a General Electric 20 h. p., 550 volt, 60-cycle, three-phase induction motor direct-connected to a 15 kw., 125-volt, direct-current generator, the speed of the set being 1200 r.p.m. The steam driven set, which is used only in starting the plant, consists of a horizontal non-condensing Curtis turbine coupled to a 2-pole 25 kw. generator, making 3600 r.p.m. This set is provided with an automatic chain driven oil pump and reservoir, with pressure gauge. About 4 lb. per sq. in. pressure is used in the bearings.

The engine room is equipped by a 20,000 lb. hand-operated Pawling & Harnischfeger crane with a 37-ft. span. The height of the engine room is 37 ft. Against the south wall is set a single panel similar to those used in the switchboard, which carries steam and pressure gauges.

Auxiliaries.—In the basement beneath each turbine is installed a Wheeler surface condenser having 1815 sq. ft. of cooling surface. There are about 1200 ¾-in. by 8 in. by 1¾ tubes in each condenser, which is equipped with a Voltz auxiliary feed water heater. The maximum capacity of each condenser is 1100 lb. per hour, with 28 in. vacuum, 30 in. barometer and circulating water at 70 degrees F. The circulating pump for each turbine has a 6-in. steam and an 8-in. discharge cylinder with 6-in. stroke, and the air pump cylinders are 6-in. by 14 in. by 10 in., steam driven.

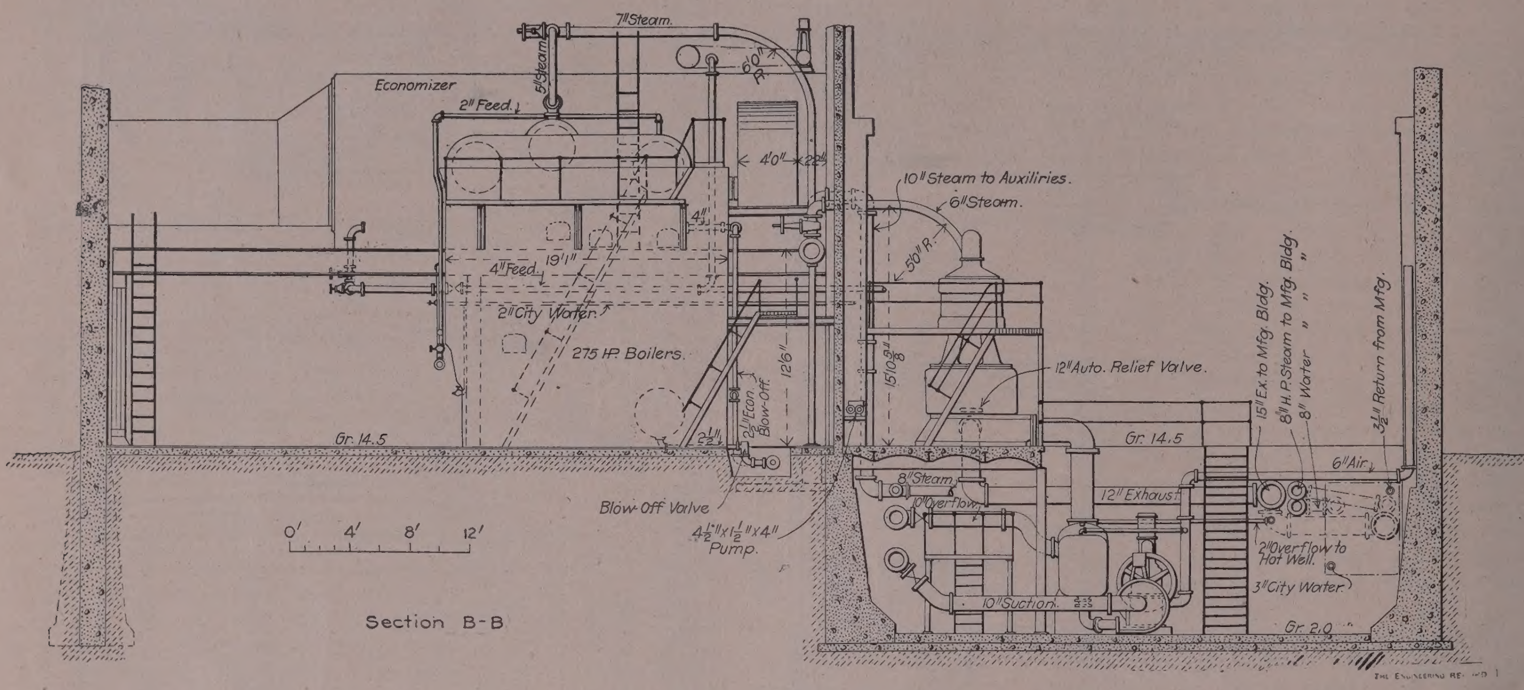
In addition to the steam and water piping installed in the basement there is a 1500 h. p. National feed water heater containing eight coils of 1⅝-in. copper tubes expanded into outside headers. These headers are made so that any one coil can be shut off in case it becomes defective. The heater is capable of supplying 1500 h. p. of boilers with feed water at 200 degrees F. and has 500 sq. ft. of heating surface.

Switchboard.—Adjoining the condensing apparatus, and at the entrance of the pipe and wire tunnel, is a fuse rack through which all the

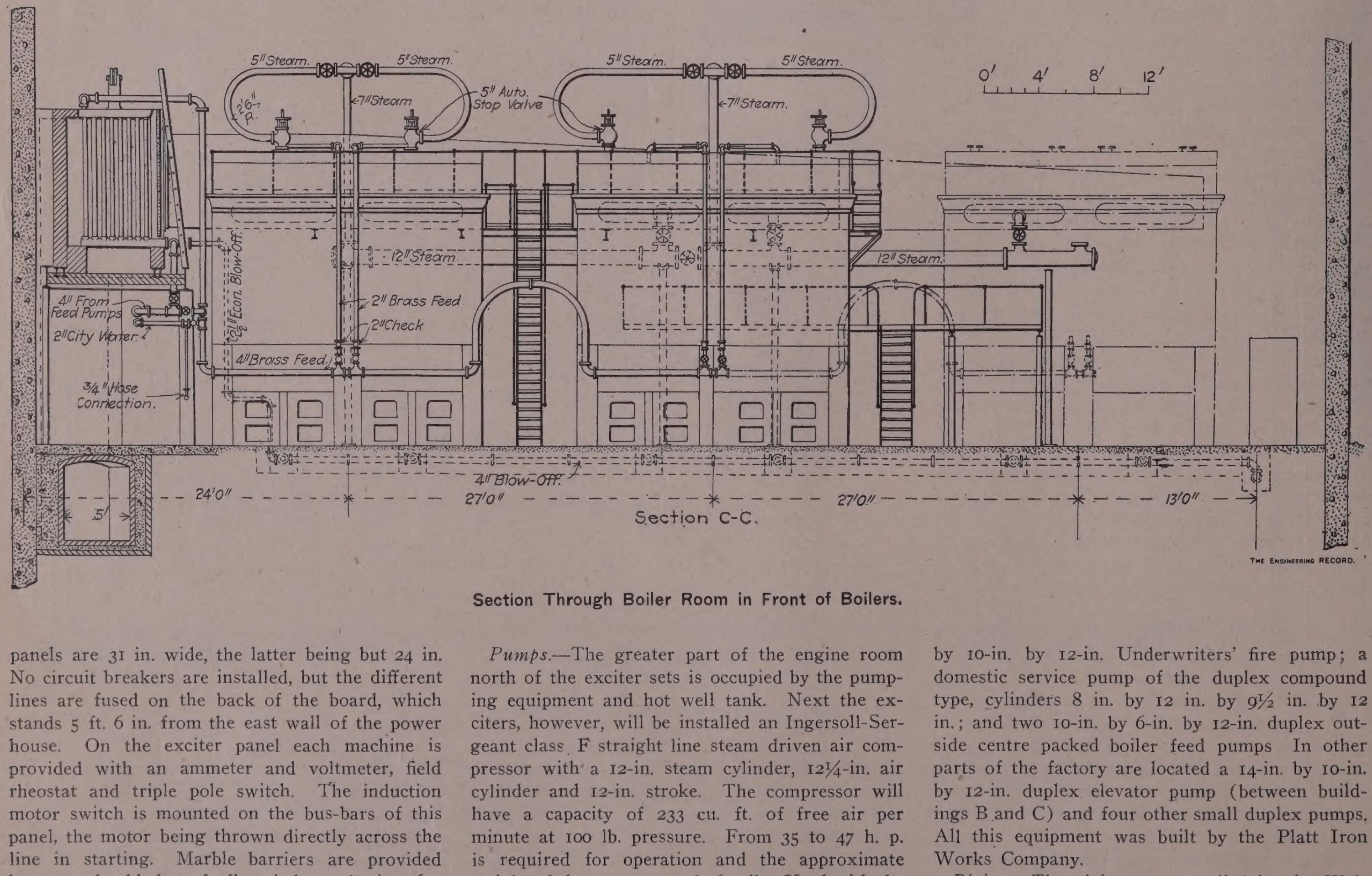


General Plan of Piping in Power House.

lighting and power cables, 36 in number, pass before leaving the power house. The field rheostats for the alternator and the larger current transformers belonging to the switchboard instruments are mounted on the basement ceiling. Directly overhead in the engine room is the switchboard, which consists of seven blue Vermont marble panels equipped with General Electric apparatus. The board is nearly 17 ft. long, and consists of one exciter, two generator, two power and two lighting panels. All except the lighting panels are 31 in. wide, the latter being but 24 in. No circuit breakers are installed, but the different lines are fused on the back of the board, which stands 5 ft. 6 in. from the east wall of the power house. On the exciter panel each machine is provided with an ammeter and voltmeter, field rheostat and triple pole switch. The induction motor switch is mounted on the bus-bars of this panel, the motor being thrown directly across the line in starting. Marble barriers are provided between the blades of all switches carrying 600 volts. No special features are installed upon the generator panels, but an ammeter is provided for each phase. A synchroscope is bracketed at the end of the board and the power panels are equipped with indicating wattmeters and the necessary three-phase switches. There are two recording wattmeters, one for the power output and the other for the lighting supply. The lighting switches are double pole, with a single barrier between each blade; distribution being on the two wire plan from the three-phase bus bars.



Section Through Engine and Boiler Rooms.



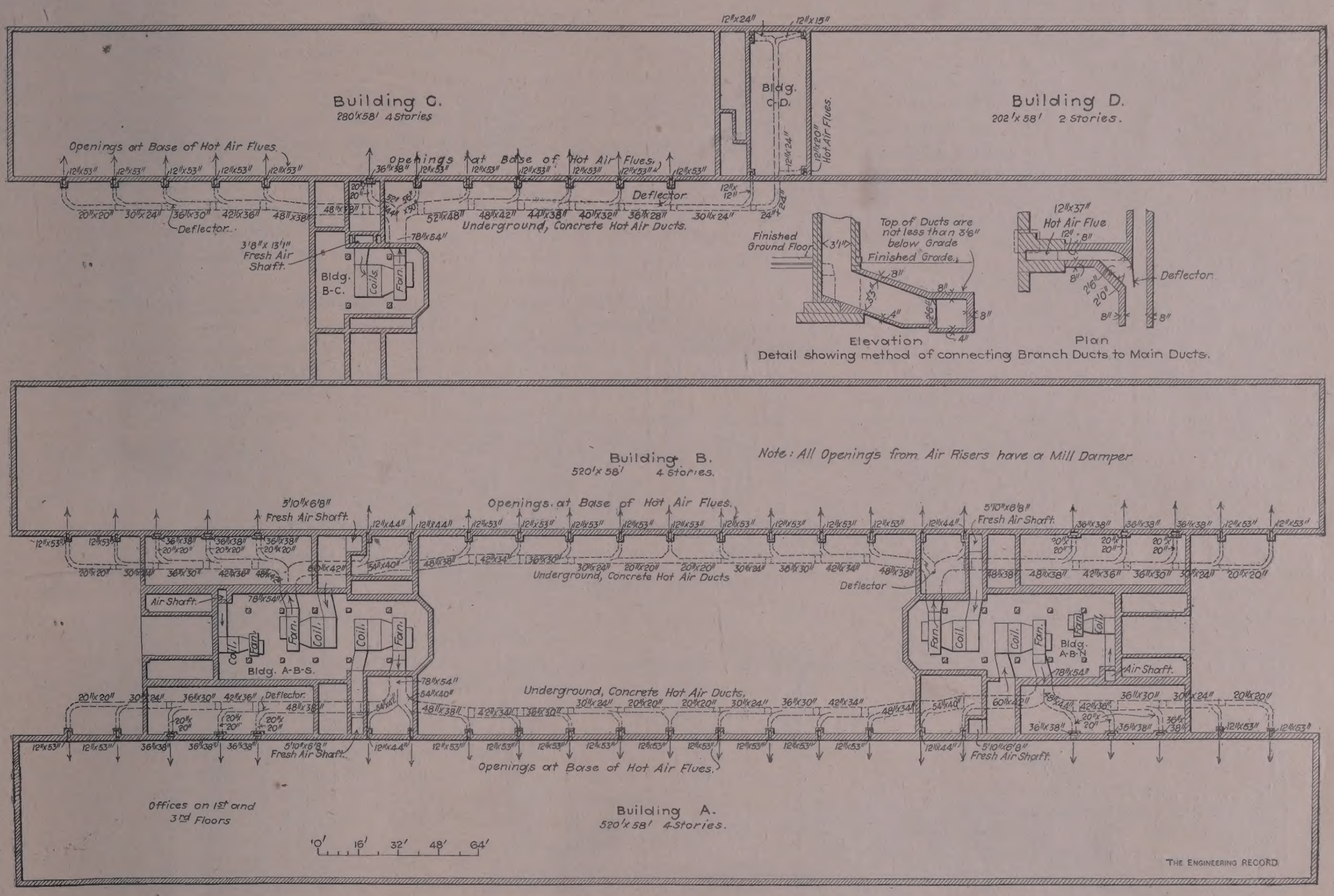
Section Through Boiler Room in Front of Boilers.

Pumps.—The greater part of the engine room north of the exciter sets is occupied by the pumping equipment and hot well tank. Next the exciters, however, will be installed an Ingersoll-Sergeant class F straight line steam driven air compressor with a 12-in. steam cylinder, 12¼-in. air cylinder and 12-in. stroke. The compressor will have a capacity of 233 cu. ft. of free air per minute at 100 lb. pressure. From 35 to 47 h. p. is required for operation and the approximate weight of the compressor is 600 lb. Used with the compressor will be a 36-in. by 72-in. vertical air receiver. The air will be used for operating the pneumatic hoists in the foundry, chipping, blowing out motors, sweeping and cleaning in the various buildings.

The hot well tank is built of boiler iron and is 5 ft. in diameter by 16 ft. long. Its connections with the feed water, exhaust and overflow piping are shown in the accompanying illustrations.

The pumping equipment is composed of four units. There are a 1,000-gallon per minute 18-in. by 10-in. by 12-in. Underwriters' fire pump; a domestic service pump of the duplex compound type, cylinders 8 in. by 12 in. by 9½ in. by 12 in.; and two 10-in. by 6-in. by 12-in. duplex outside centre packed boiler feed pumps In other parts of the factory are located a 14-in. by 10-in. by 12-in. duplex elevator pump (between buildings B and C) and four other small duplex pumps. All this equipment was built by the Platt Iron Works Company.

Piping.—The piping was supplied by the Walworth Mfg. Co., of Boston. High pressure steam pipes 6 in. and above are of steel with extra heavy flanges; 5 in. and below they are of full weight wrought iron, with extra heavy flanges made on, planed and refaced. High pressure valves are extra heavy with steel stems and nickel iron seats, suitable for superheated steam. The main exhaust lines are of standard weight cast iron flanged pipe and auxiliary exhaust lines, wrought iron. The free exhaust is of spiral riveted flanged pipe. The boiler feed main and leads to each boiler are of brass pipe and the circulating water and pump suction lines are of cast iron. All clean drips are trapped to the hot well, oily drips being trapped to waste. Cochrane high pressure steam and oil separators are used, while the Holly system is installed for returning the high pressure drips automatically to the boilers.


Building C.
280'x58' 4 Stories
Openings at Base of Hot Air Flues.
Bldg. C-D.
Hot Air Flues.
Building D.
202'x58' 2 Stories.
Deflector
Underground, Concrete Hot Air Ducts.
3'8"x13'1" Fresh Air Shaft.
Bldg. B-C.
Coils
Fan
Top of Ducts are not less than 3'6" below Grade
Finished Ground Floor
Finished Grade
12"x37" Hot Air Flue
Elevation
Plan
Detail showing method of connecting Branch Ducts to Main Ducts.
Building B.
520'x58' 4 Stories.
Note: All Openings from Air Risers have a Mill Damper
5'10"x6'8" Fresh Air Shaft.
Air Shaft
Bldg. A-B-S.
Bldg. A-B-N.
Building A.
520'x58' 4 Stories.
Offices on 1st and 3rd Floors
0' 16' 32' 48' 64'
The Engineering Record

Plan of Outside Air Ducts, Buildings A, B, C and D.

Heating.—The heating system of the Beverly works was installed by Joseph McWilliams & Co., of Louisville, Ky. The buildings heated are: A, ABS, ABN, B, BC, C, D and E. All except buildings C and D are heated by the fan system, these two being heated by direct radiation from coils of 1¼-in. pipe attached to the walls as shown upon the plans. The general layout of the hot air ducts for the buildings A, B and C is shown in one of the illustrations. These ducts are run underground and are entirely of concrete. They run practically the entire length of the various buildings. The branch ducts leading from the mains to the vertical flues are also of concrete. The flues running up the walls of buildings A, B and C have an inner course of hollow brick 4 in. thick.

The basements of buildings ABS, ABN and BC are called "fan rooms" and are given up entirely to fan apparatus. Three separate plants are installed in each of the buildings ABS and ABN, and one in building BC. Two separate plants are used for heating A, and two for B, one of each of these plants being placed in ABS and ABN. The smaller equipment in ABS and ABN is used for heating the lavatory wings.

Each of the two plants for A and also for B consists of a heater coil containing 9,000 ft. of 1-in. pipe and a 200-in. fan with three-quarter steel plate housing, the wheel being 10 ft. in diameter, 60 in. wide at the centre and 50 in. wide at the periphery. A 45-h.p. engine of the horizontal straight line type with a 10-in. by 12-in. cylinder is used for operating each fan. The speed is 165 r.p.m. at 80 lb. pressure. The equipment for buildings C, BC and CD consists of one 10,776 linear ft. coil made up in 12 sections with a 200-in. fan driven by a 10-in. by 12-in engine. The fan wheel is 10 ft. by 4½ ft. in dimensions. Buildings ABN and ABS are equipped with a single 3210 linear ft. coil, and one 120-in. fan with 78 in. by 42 in. wheel driven by a 7-in. by 10½-in. engine making 250 r.p.m. at 80 lb. pressure. The fans, coils and engines were supplied by the B. F. Sturtevant Co., of Hyde Park, Mass., the coils being made up with corrugated bases. The engines are of the side crank pattern, provided with throttling governors and attached to the fans by flanged couplings. The fans have top angular updischarge with sheet iron connection between the outlets and mouths of the concrete ducts. The foundations of the entire equipment are of 1:2:4 concrete.

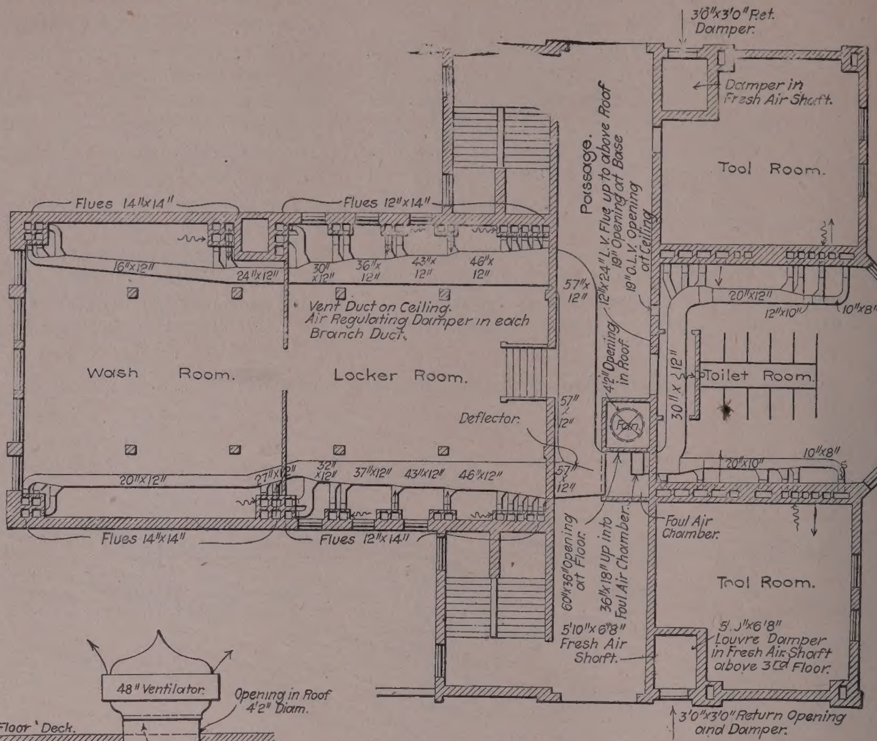
The complete excavations for these foundations were lined with 4-in. brick abrasion walls and the inner face of the walls given three coats of heavy water proofing. The concrete foundations were then built. Each of the vertical hot air shafts extending up alongside buildings A, B and C have an opening into the ground and at the first, second and third floors. Each opening is equipped with a mill damper complete with heavy wire screen and adjustable rod, so that they may be operated from the floor. An adjustable sheet iron deflector, held in place by a spring stop, is attached to the mouth of each branch duct where the latter connects with the main.

Drawing C 494 shows the galavanized iron ducts which supply hot air to the various rooms in ABS. These ducts are suspended from the ceilings of the fan rooms. The arrangement of ducts in ABN is the same as that in ABS. The vertical hot air and vent flues for these buildings are of concrete, and are built into the walls as shown. At the top of ABS and ABN is a system of galvanized iron ducts for removing the foul air from the various vent flues to the foul air chambers, as shown in the illustrations. A similar arrangement is in use for building ABN. The foul air is exhausted by a 48-in. disc fan of the American Blower Company's works, vertical shaft type and operated by a direct-connected electric motor. The ventilating shaft leads up through the roof of the building, the top being capped by a 48-in. globe ventilator.

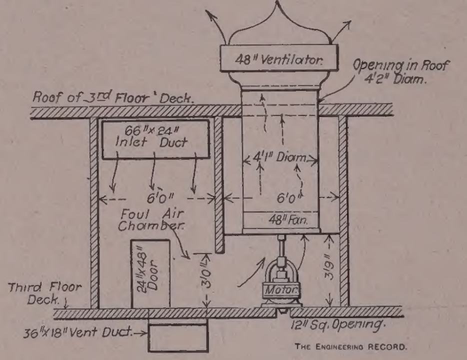
The fan apparatus is designed to heat buildings, A, B, C, ABS, ABN, BC and CD, to a temperature of 70 degrees F in zero weather. Each fan for building A is designed to supply 60,000 cu. ft. of air per minute, making a total of 120,000 cu. ft. for this building. The air on the first floor is to be changed once every 15 minutes, on the second and fourth floors once every 16 minutes, and on the third floor, once in 18 minutes. The two fans for building B are to deliver 57,500 cu. ft. of air each per minute. The main concrete air ducts are figured for a velocity of 2,400 ft. per minute. In the branches the velocity of the air will be 2,100 ft., and in the vertical flues, from 1,200 to 1,800 ft. per minute. At the various openings the velocity will be from 300 to 600 ft. per minute. Building D is heated by wall coils containing 3,530 sq. ft. of heating surface and building E by 7,415 sq. ft. of similar coils. These coils are made up of 1¼-in. and 1½-in. pipe screwed into heavy cast-iron headers. All coils are attached to the building walls by brackets and expansion bolts.

The offices on the first floor of building A are heated and ventilated by separate galvanized iron ducts leading out from the main hot air risers or shafts on the outside of the building. A separate system of ducts is also provided for heating the offices on the third floor of this building. The ducts are beneath the offices' floors in both stories, the registers being in the floor. Ventilating ducts are also provided for these offices with vent faces located in the floor. These ducts connect to a central vent shaft shown on the drawings. At the top of this shaft is placed a 30-in. motor driven ventilating fan which discharges the foul air through a 31-in. copper shaft. The top of this shaft is capped by a globe ventilator and the inner surface of the main shaft is lined with No. 20 galvanized iron. The draughting room on the second floor is heated from the main vertical shafts, but a separate system of vent ducts is provided for this room.

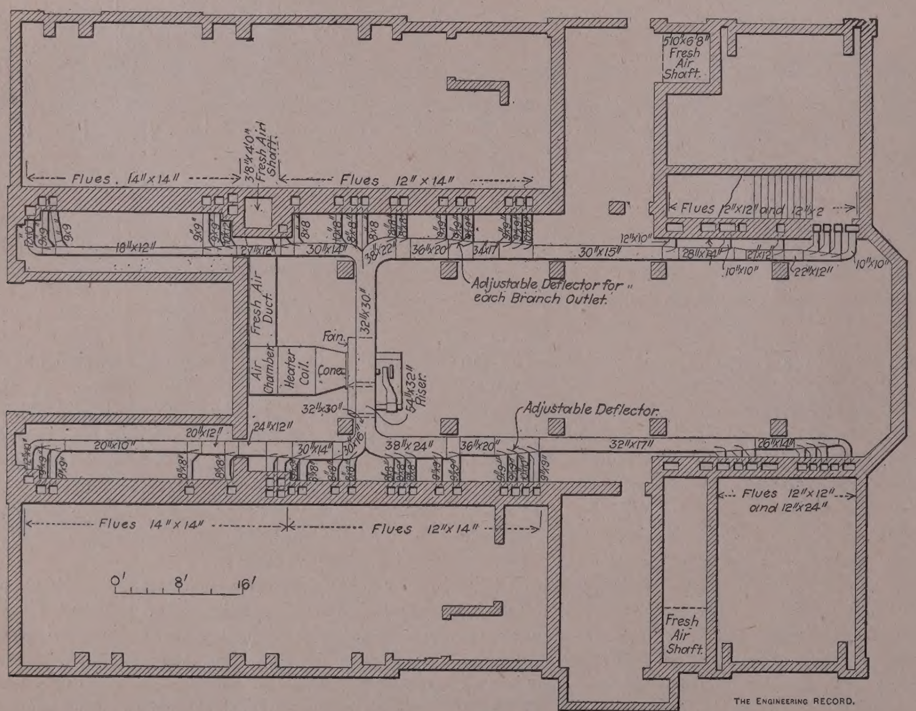
The Webster system of steam heating is used in the plant for supplying the fan apparatus for the various buildings and also the direct heating surface in the remaining buildings. Steam at 1 lb. pressure is taken from the exhaust mains in the power house basement and carried away through the tunnel in a 15-in. pipe. The main tunnel, as has been indicated before, passes through E and thence across C, BC, B and ABS. Connections are taken off as desired. Another branch tunnel runs across D and B to the fan chamber of ABN. An 8-in. high pressure main is run from the boiler room in the power house through the underground tunnels, paralleling the low pressure heating main, for supplying steam to the engines, pumps, etc. The exhaust pipe from each engine is connected to the low pressure heating main, supplying each apparatus so that the various plants are independent. The returns from the coils in ABN and D, the returns from the fan equipment in ABS and BC, and the returns from the coils in E are discharged by vacuum pumps directly into the main vacuum return line which runs through the tunnels to the hot well in the power house. The engines are provided with steam separators drained through Kieley traps into the main return lines. Automatic pumps and receivers are provided in bindings ABS and ABN for receiving the surplus drainage and the oil of the exhaust. These pumps discharge into the sewer and are located in the fan rooms.


3'6"x3'0" Ret. Damper.
Damper in Fresh Air Shaft.
Tool Room.
Passage.
12"x24" L.V. Flue up to above Roof 19" Opening at Base 19" O.L.V. Opening at Ceiling
Flues 14"x14"
Flues 12"x14"
16"x12"
24"x12"
30"x12"
36"x12"
43"x12"
48"x12"
57"x12"
Vent Duct on Ceiling. Air Regulating Damper in each Branch Duct.
Wash Room.
Locker Room.
Deflector.
42" Opening in Roof
20"x12"
12"x10"
10"x8"
Toilet Room.
30"x12"
Fan
20"x10"
10"x8"
20"x12"
27"x12"
32"x12"
37"x12"
43"x12"
46"x12"
57"x12"
Flues 14"x14"
Flues 12"x14"
60"x36" Opening at Floor.
36"x18" up into Foul Air Chamber.
Foul Air Chamber.
Tool Room.
5'10"x6'8" Fresh Air Shaft.
5'10"x6'8" Louvre Damper in Fresh Air Shaft above 3rd Floor.
3'0"x3'0" Return Opening and Damper.
The Engineering Record.

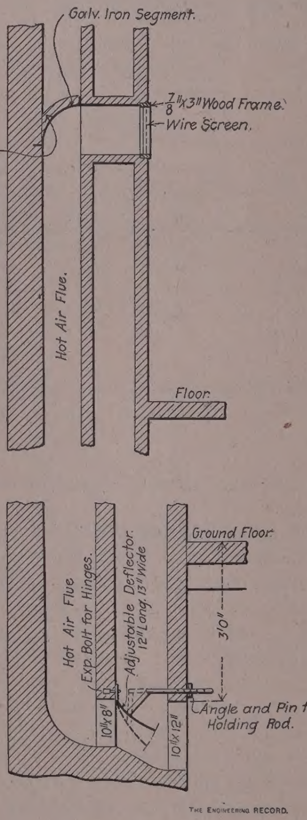
Heating and Ventilating System, Third Floor, Building ABS.



Foul Air Roof Chamber, ABS.



Heating Plan of Basement of Building ABS.



Hot-Air Flues, ABS.

Under the skylights of the low portions of ABS and ABN are provided snow melting coils supplied from the low pressure heating mains. Coils are also place in the space over the driveways of ABS and ABN. Branches are run from the high pressure heating mains in buildings ABS, ABN and BC for supplying steam to the hot water boilers used for lavatory purposes in these buildings.

It is intended that the air in A, B and C should be recirculated, but provision is made for using fresh air. The air supply for the fans is taken direct from the main air shafts which lead up through the various buildings to the roofs. Each of these shafts has a large opening into each floor of the main buildings. Louvre dampers are fitted to the openings and also to the top of each shaft. These dampers are connected by reversing chains so that they operate simultaneously, the intention being to have the fresh air inlets at the top of the shafts closed when the return openings are open, or vice versa. The Johnson system of temperature regulation is used in buildings A, B and C.

The large heater coils for these buildings are divided into three separate sections. The first or outer section is used as a tempering coil and has no automatic regulation. A diaphragm valve is inserted in the steam pipe leading to the two remaining sections of each of these coils, the valve being operated by a thermostat. When the temperature in A, B or C reaches 68 degrees F. the thermostat closes the diaphragm valves in the second section of each of these coils and at 69 degrees a second thermostat closes the diaphragm valve in the third section of each of the coils and also opens the by-pass dampers beneath the coils. Two by-passes, each with a damper, are provided under each of the large coils, but no by-pass is provided for the small apparatus in buildings ABS and ABN.

Elevators.—The elevator equipment consists of nine direct-plunger type hydraulic machines supplied by the National Plunger Elevator Company, of Worcester, Mass. One elevator is used for passenger service only, while eight are employed for combined freight and passenger work. All are designed to be operated on a water pressure of 150 lbs. per sq. in. Three are located in A, two in B, two in C and two in E. The usual run is 40 ft. 9 in. and the speed of all except the passenger is 50 ft. per minute. The latter makes 125 ft. per minute.

Besides the 14x10x12-in. duplex pump mentioned the elevator plant is equipped with one discharge tank made of cement and two pressure tanks of 2,500 gals. capacity each, made of steel and capable of withstanding 250 lbs. per sq. in.

Motors.—The motors and wiring were installed by the General Electric Company, as was the lighting system. There are some 37 motors all told, ranging from 1 to 75 h.p. All are of the three-phase induction type, 60 cycles, 550 volts. Practically the entire factory is group-driven except for the fans. In the foundry the blowers are direct-coupled. About 80 alternating enclosed arc lamps are installed upon a general lighting circuit throughout the plant, including the foundry, but the bulk of the artificial lighting is carried out by 16-c.p., 110-volt incandescents. The transformers for these are mounted on frames outside the building walls.

Besides the contractors mentioned, pipe covering was supplied by the H. W. Johns-Manville Co., of Boston, machinery foundations and crane runways by the New England Structural Company, of Boston, and the flues and hot well by Edw. McCabe, of Lawrence, Mass. The consulting engineers for the power plant were Messrs. Dean & Main, of Boston. The mechanical superintendent of the Beverly works is Mr. S. D. Leland, under whose direction the entire installation has proceeded.

A Single-Phase Railway, about 13 miles long, is operated in the Borinage coal district west of Mons, Belgium. The generating station supplies three-phase, 40-cycle, 6,600-volt current for power and lighting service as well as single-phase for the railway. The Winter-Eichberg type of motors are used.

Difficulties of Construction in an Outlet Sewer.

The joint outlet sewer of eleven municipalities in Essex and Union counties, New Jersey, of which Mr. Alexander Potter has been chief engineer from the organization of the work, was described at considerable length in The Engineering Record of March 5, 1904. The work was recently completed, and in a general report describing it Mr. Potter explains a number of the unusual difficulties that were encountered, some of which have already been discussed by him in communications to this journal.

Tunneling.—The sewer drains two valleys, the Rahway and Elizabeth, and is carried across the divide separating them in a tunnel, which at one point has its grade line 62½ ft. below the surface. The borings along the line originally surveyed for the sewer convinced the engineer that the excavation would prove to be of the most difficult nature, a large proportion of the material being a drift composed of clay, sand, quicksand, boulders of a great variety of sizes, and water, in varying percentages, sometimes differing widely in character within short distance. The line was changed, therefore, to reduce as much as possible the excavation of a greater depth than 22 ft., considered in this case to be the economical limit of tunnel construction, although by so doing the length of sewer was somewhat increased. The wisdom of this change was clearly demonstrated when work was started on the tunnel by the open heading method.

The responsibility for the execution of this contract fell on Carrol Ph. Basset, C. E., he having gone surety of the company. The contractor sank a shaft and attempted to drive a heading from it by the ordinary methods for timbering in soft ground, but in four months excavated only about 30 ft. of tunnel, at an expense of between $4,000 and $5,000. The timbering was so badly displaced and twisted as to be only an obstacle in the way of any further operations at that place. When the utter uselessness of proceeding further by this method was realized, work on the tunnel was temporarily abandoned. The suggestion of Mr. Potter to adopt the use of compressed air was concurred in by Mr. W. M. Brown, Jr., engineer of the Metropolitan Sewerage Works, of Boston, who was called in consultation, and the size of the sewer was increased from 38 in. to 48 in., which allowed the brickwork to be completed as the excavation advanced, thus simplifying the construction. An auxiliary agreement was entered into with the contractor giving him an increase over his original bid on a 38-in. tunnel commensurate with the proportionate increase in the capacity of the sewer, and a sub-contract for the compressed-air work was made with Mr. C. M. Haskins, of Boston, who installed the necessary plant into place. F. H. Dohrman was in charge of the work.

After the adoption of compressed-air methods the work in the tunnel was conducted from two new shafts, one 40 ft. deep, the other 22 ft. The former was made by open excavation to a depth of 25 ft. through gravel into compact material. A 12-in. timber deck was constructed at this level, on which was bolted a 4-ft. steel cylinder, extending to the surface, to the upper end of which a T-shaped, double-chambered air lock was attached. The deck was cut out inside the cylinder, and when air was admitted a brick casing was carried down under the deck to the level of the sewer.

The major portion of the plant was located at the deeper shaft and a 5 and 6-in. line of pipe for compressed air was run to the second shaft. The plant at the main shaft consisted of a 75-hp. upright and a 60-hp. horizontal boiler, a 6x4x6-in. Worthington feed pump, a 6x8-in. automatic engine, a General Electric 30-kw. generator for lighting, a Davidson 10x16x16-in. compressor, an Ingersoll-Sergeant 16x20x24-in. spray compressor, a Knowles 12x16x8-in. water-jacketed compressor, an air receiver, a 6x8-in. double-drum Flory hoisting engine, and a 6x4x6-in. Worthington pump. This shaft was fitted with a 5x5x12-ft., T-shaped steel plate lock, with two chambers.

The machinery at shaft No. 2 comprised a 20-hp. Mundy boiler, a 6x8-in. Flory single-drum hoisting engine, a 4½x2¾x6-in. Blake pump and a 10x20x24-in. Knowles compressor. At this shaft there was a vertical, single-chamber, cylindrical air-lock, 6 ft. in diameter, with a door in its bottom opening directly into the top of the shaft. Through this door cylindrical buckets of 6 cu. ft. capacity were lowered and hoisted to convey the spoil from the excavation and the materials for the tunnel lining.

Work was started at the first shaft in June, 1903, and at the second shaft in October, 1903. Up to the first and at the second shaft in October, 1903, 2,500 ft. of sewer were built from the first shaft, and 1,230 ft. from the second shaft, the progress averaging 12 ft. for each working day.

Where the tunnel went through drift the material was so homogeneous that the air losses were small, and the excavation proceeded without the use of plates or shields, excepting where quicksand was encountered, and then roof plates were necessary. These were made of ⅛-in. sheet steel and were stiffened on their edges with 1¾x1¾-in. angles, which also served as flanges and had bolt holes spaced 6 in. apart. Each plate is 1 ft. wide by 2½ ft. long. Alternately, two and three plates were used in a course in the roof of the heading, the longitudinal joints being staggered and the spaces at the ends of the two-plate courses filled with small pieces of thin board. These plates were temporarily held in place by extension braces, the bottoms of which rested on timber blocking. As rapidly as the plates were placed all joints between them were bolted and then covered with blue clay of the consistency of putty, smeared on by hand, to prevent air leakage. The roof of the tunnel at one point comes to within 10 ft. of the surface, and the air was held at this place with extreme difficulty. Wherever possible the plates were removed as the lining was built; in other places the brickwork was built against them.

The air pressure required varied from 10 to 15 lb. per square inch. This expelled the ground water so thoroughly that the materials which had given such insuperable difficulty when attacked by the open-heading method could now be excavated comfortably and expeditiously, much of the time not even requiring boards at the faces of the headings, although the diameter of the excavations was about 5½ ft. However, nests of boulders gave some trouble and occasionally an unusually large boulder had to be blasted. The spoil and the materials for the lining were transported to and from the shafts in small cars, pushed by hand along a narrow-gauge track. Near each shaft the vertical diameter of the lined tunnel was made slightly greater than 4 ft., as a matter of convenience during construction. Excepting the bricklayers, the men employed in the tunnel were colored laborers and worked in two twelve-hour shifts. Excavation and lining followed each other successively in each heading in alternate shifts. When the work was well organized and no unusual difficulties were encountered, from 15 to 20 ft. of tunnel were excavated and lined in each heading per day. The tunnel was illuminated with incandescent electric lights. This method of tunneling has proved so successful that this portion of the sewer has been built more expeditiously and economically than some of the portions in deep open cut.

As soon as a stretch of brick sewer was finished its whole interior surface was given a thoroughly applied wash of Portland cement grout, which grout by reason of the air pressure inside the sewer was forced into the bricks, changing entirely the porous nature of the brickwork so that no air escaped through the brick rings. The permanent advantage of this cement washing was shown after the air pressure had been discontinued, by the fact that, although the tunnel section is subjected to a head of ground water varying from 15 to 25 ft., the amount of seepage through its walls was extremely small. Another advantage gained by the grout application was the smooth interior surface thereby secured.

The conditions governing the alignment of the tunnel were as follows: Shaft No. 1 was located 996 ft. above the end of the sewer and built in open cut. Shaft No. 2 was located at a distance of 1,928 ft. from Shaft No. 1 and 800 ft. below the other end of the open cut sewer.

The only opportunity for the direction of the work was from these shafts, which were each about 8 ft. square inside of the timbering. On either side of these shafts and on the center line of the sewer was placed a 6-in. vertical pipe used for passing rails and other material too long for the lock. These pipes were fitted with screw caps at top and bottom, the upper caps being tapped with a ¾-in. pipe set slightly eccentric, so that as the cap of the larger pipe was screwed to place a fine drill hole in the cap of the small pipe could be brought exactly on line, and through these holes the plumb lines were suspended.

The special difficulty of the work was caused by the fact that, as at both shafts the locks extended about 8 ft. above the surface of the ground, there was no point at which the instrument could be placed and both plumb lines aligned simultaneously, as is the practice at the shafts of railway and mine tunnels. This required the separate alignment of each plumb line from opposite sides of the shaft and increased greatly the probability of error. The plumb lines being fixed at the top of the shaft, there remained the projecting of this line in the tunnel below, which was effected as follows:

The lines were weighted at the bottom with heavy bobs suspended in pails of water to check vibration. The instrument was then placed at a distance of a few feet beyond the wires and shifted in position until exactly in line with both, when the line so obtained was projected in the direction of the headings and points marked by staples driven in the roof of the tunnel. The plumb "lines" mentioned were in reality fine copper wires, as the cord ordinarily used would have been useless because of its thickness and its propensity to twist when used in lengths required in the shafts.

The line having been brought down as described, was extended as the tunnel progressed, although smoke, steam and the constant pulsation of the air from the compressors added greatly to the difficulties of exact instrumental work.

The original location of the tunnel was on tangent throughout, and work had been started on the tunnel by the open-heading method and subsequently abandoned. The necessity, therefore, of avoiding the abandoned headings required the use of a curve at a distance of 730 ft. east of Shaft No. 1. The ends and center of this curve were fixed by angular deflection and the brickwork laid by means of a templet cut to the radius of 50 ft. The fact that the instrumental work was done in a tunnel four feet in diameter, of course, necessitated the use of a special tripod and rod of lilliputian size, and the inconveniences and difficulties of performing the ordinary engineering operations when water and muck occupied a considerable portion of the limited space can readily be imagined.

As the east heading of shaft No. 1 approached the sewer built in open cut the difficulties of construction rapidly increased. These were caused largely by the fact that in building the open cut sewer a steam pump was maintained at this point so long that the finer material was drawn out of the drift, leaving a porous gravel, through which the air readily escaped, allowing the water to rise to a depth of more than one foot on the invert. An attempt was made to drive a pipe from the surface, through which the water might be forced by the air pressure, but this was so badly bent from its course by striking boulders as to be rendered useless. As a final expedient holes were cut in the brick arch, into which short pipes were inserted and the water driven upward into the surrounding material. The plates were placed in position as soon as space was excavated for them and immediately daubed with clay. The progress on the last 20 ft. was less than 2 ft. per day excavated and made fairly impervious. When once the plates were extended over the brickwork of the open cut portion of the sewer the masons were able to connect the ends of the sewer in a satisfactory manner, and the cutting off of the leakage reduced the draft on the compressors to less than half of what had been required previously of them. Mr. Irving Hawkins, C. E., was resident engineer on tunnel work.

Movement of Exposed Iron Pipe.—When the sewer crossed property from which a ground water supply for Elizabeth is drawn a 36-in., cast-iron pipe, 1,491 ft. long, supported above ground on concrete piers, was used. It was completed for a year before being put into service. During this time it was exposed to the sun without any water in it that would modify the limits of expansion and contraction due to the variations in extremes of temperature, and the effect of the changes in the pulling of the joints could be studied to the best advantage. The extreme difference in the measurement of each 12-ft. length of pipe produced by changes of temperament was ⅛ in. It was noticed that in a number of cases the lead began to pull out with changes in the temperature, and in all such cases the lead was cut out of the joints, weighed and found to be less than called for by the specifications and not sufficient to engage the annular depression on the outside of the bell. Much importance was not attached to the engaging of the lead in this annular depression, as the joint was not to be subjected to any pressure, and hence no modification of the ordinary shape of pipe used in water works construction was called for in the specifications, and in the pipes delivered the depression was 2 in. back from the face of the bell in consequence, requiring an excess of lead to engage it. Since rerunning these joints there has been no evidence whatever of any pulling out of the lead. Had the depression in the bell been placed 1 in. from the face, 45 lb. per joint of lead would have been ample instead of 65, the actual amount used.

Tar Cement Joints.—On a section of vitrified pipe sewer where more than half the work was in wet trenches cement joints were not used. Instead a gasket of strands of jute soaked in North Carolina tar was well caulked into the annular space, the inside of the socket and the outside of the spigot of the pipes fitted together, having previously been swabbed with tar. Into a bucket filled with Portland cement North Carolina tar was poured and kneaded by hand with the cement until a rather stiff dough-like consistency was secured. This substance was then rolled on a board to a sufficient length and diameter and placed in the annular space between the fitted pipes, into which space it was thoroughly rammed by suitable tool and hammer until the space was completely filled to within ½ in. of the end of the socket. The usual beveled cement mortar finish was then given the pipe joint.

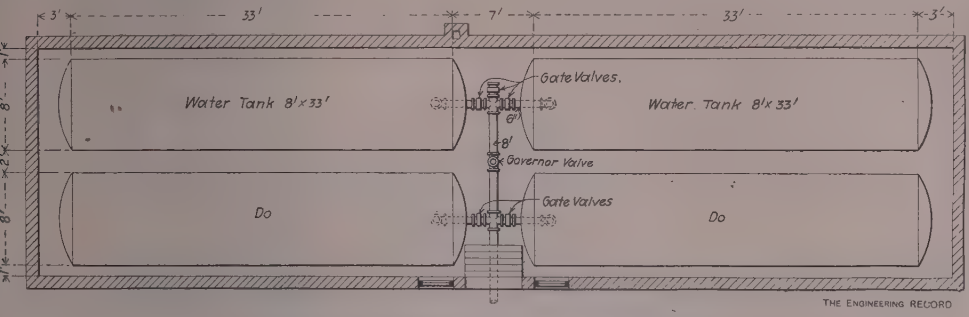
The tar cement mixture, when properly made, Mr. Potter says, becomes tough and moderately hard in several hours, depending on the temperature and proportion of cement incorporated. The objectionable feature of the tar cement joint is its plasticity in warm temperature, more especially when used in the larger sizes of pipes. In filling the annular space with this mixture the weight of the material is oftentimes sufficient to cause the mess of tar cement to flow before it sets, causing it to drop away from the under side of the upper portion of the bell before the tar cement has properly hardened. Again, unless the spigot end of the pipe is supported on solid bearing, such as small chips or especially burned pieces of vitrified clay, embedded in the tar cement in the bottom of the joint before the following pipe is inserted, the weight of the pipe will compress the tar cement in the bottom of the joint before it hardens, causing the filling material in the upper portion of the annular space to be drawn away from contact with the inside of the top of the bell, thus introducing a chance of leakage in water-soaked ground.

Wooden Underdrains.—A method of vitrified pipe support called "wooden underdrain" used on several sections of the joint sewer proved to have many points of excellence. It was used in wet trenches, and especially on quicksand, and consisted of four pieces of 2x4-in. plank laid flat 6 in. between centers, on top of which were nailed pieces of 4x4-in. timber 1½ ft. between centers. The pipe rested on the 4x4-in. pieces, being held in position until the backfilling was placed under and around it by wooden wedges placed between the 4x4-in. pieces and the pipe and nailed in position. The space between the 2x4-in. pieces and the space under the supported pipes acted as a channel to drain away the water in the trench to the pump pit, allowing the joints to be cemented and kept dry until set. The number of 2x4-in. pieces and the length of the 4x4-in. blocks varied with the size of the pipe to be laid, the usual length of the 2x4-in. pieces being 9 to 12 ft. The filling of the space between the 2x4-in. and the 4x4-in. pieces with coarse gravel worked well to drain trenches in quicksand, which substance would have choked up even short lengths of pipe under drain, rendering them almost if not quite useless.

The objection to this form of construction, Mr. Potter says, is that it, perhaps, requires greater care in backfilling in clay, loam or other compressible soils, but this is not in reality an objection. That poor backfilling is the principal cause of failure in sewer construction there is little doubt in his mind. Anything which tends, therefore, to promote and require greater care in backfilling, especially under and around the pipe, is to be desired. An inspection of the interior of the entire length of the sewer was made by an assistant engineer, and the condition of the pipes carefully noted. An assistant engineer actually crawled through every pipe of 20 in. and over in the entire sewer. The inspection of pipes smaller than 20 in. was made with the aid of mirrors. Not a single defective pipe was found in any portion of the system where quicksand was encountered, and this method of underdrain had been used in whole or in part, but in clay, gravel and rock cuts some pipes were found broken.

Trouble with Sheathing.—On one of the sections extreme difficulties were encountered where least expected. The highway followed by the sewer is built straight up a hillside, and the sewer is not over 8 to 10 ft. deep except at the upper and lower portions of it, yet throughout its entire length the most difficult kind of excavation was encountered, quicksand, drift, boulders and water in abundance. On certain portions of this work, even with close sheathing, the whole street from curb to curb was lowered 2 and 3 ft. In material such as this, where it is utterly impossible to know the condition of the ground outside of the sheathing, Mr. Potter considers, it is not safe nor is it prudent to withdraw the sheathing from the trenches. In almost eery case where an attempt was made to pull the sheathing on this street the pipe was either ruptured or thrown out of alignment to such an extent that it was necessary to dig down and replace it.

The temptation is often very great for the engineer to endeavor to save money for his clients by withdrawing sheathing which otherwise will have to be paid for, but one of the functions of the engineer is the wise determination of just where sheathing can be withdrawn without damage and where it should be left in the trench. It is Mr. Potter's firm belief, however, that in the absence of positive proof that the sewer was in an imperfect condition when the engineer ordered the sheathing withdrawn, the burden of proof would be on the engineer to show that its removal was not responsible for any damage that may subsequently have been found to have occurred to the pipe. In case damage had been wrought by the removal of the sheathing the contractor should not have to stand the cost of repairs.



Plan of Water Storage Tanks in Brick Building

Recording Gauge Chambers.—In order to be able to compute the amount of sewage contributed by any municipality and note its variation when influenced by different factors, such as time of the day, manufacturies, weather, etc., a method of continuous sewer gauging was devised by means of a Dibble recording gauge, housed in a brick chamber.

To one side of the sewer and communicating with it by 4-in. pipes is placed an 8-in., upright, vitrified pipe, to present the top of the flowing sewage in the main, unaffected by its current. Upon the surface of the sewage in the 8-in. upright pipe rests a tinned copper float, 6 in. in diameter, which, being properly counterweighted, transmits by suitable mechanism the rise and fall of the surface of the sewage to a hand on the lower dial of the recording gauge showing the depth of sewage, and also in the upper dial to a pen which marks the depth on a record sheet moved by clockwork, the sheet being divided into hours and days for one week, so that permanent record of the sewerage depth at any time during the week is secured.

There are at present thirteen recording gauge chambers on the sewer, and one of the duties of the inspectors is to visit each gauge chamber weekly, inspect the working of the gauge, wind the clock, remove the marked record sheet and insert a new one. The marked sheets are turned over to Mr. Potter, who uses them for the computation of the varying flow and quantities from the various municipalities, and from them can in large part judge of the condition of various matters relating to the system, and who has succeeded through their agency in detecting many sources of surface and ground water infiltration.

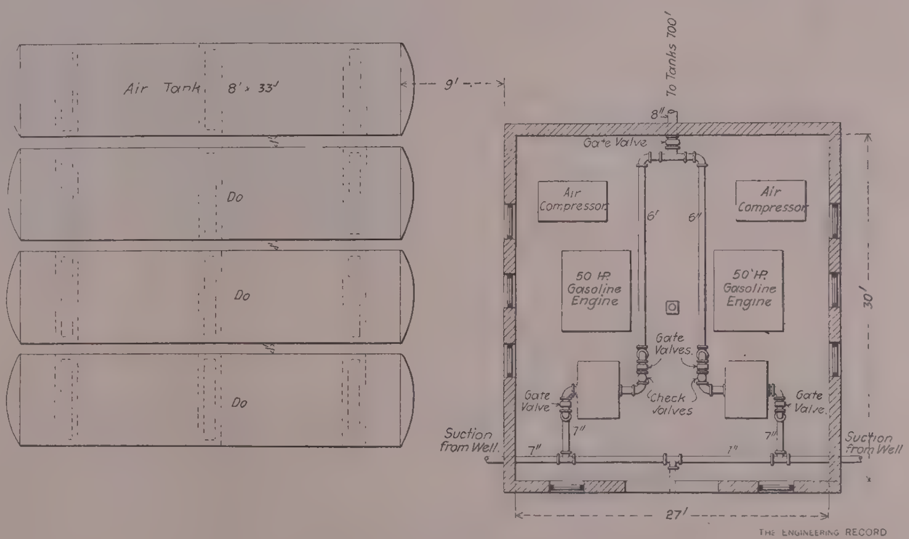
One of the most important facts so far developed is the extent to which water admitted through the perforations in the manhole covers affects the flow in the sewer. The gauges are covered with removable waterproofed canvas covers, and to prevent unauthorized persons from entering the chambers and perhaps meddling with the delicate mechanism of the clocks, which require great care in adjustment, the cast iron cover of the chamber is made with a positive locking device controlled by means of a special key.

The gradient and size of the sewer at each gauge chamber being known, the discharge corresponding to the depth of the sewage could be estimated, theoretically, by published formulæ, but it was found by preliminary experiments that the theoretical discharge deduced from accepted formulæ was not obtained. To secure the relationship between the actual discharge and the theoretical discharge a series of experiments was instituted by Mr. Potter, and are being continued, by means of which actual velocities at various depths of flow are being determined.

Port Washington Water-Works Under Air Pressure.

The village of Port Washington, N. Y., is supplied with water from three 8-in. wells through a distribution system of mains under combined compressed air and gravity pressure. The wells are located in a valley near the edge of the village and are sunk about 50 ft. into a deep stratum of gravel. The pumping station embraces a two-story brick and frame pump house building at the wells, four cylindrical air pressure tanks near the building and four water-storage tanks in a low brick building 700 ft. from the pump house and about 50 ft. above it. The pumping equipment consists of two 50-h.p. Nash gasoline engines, arranged in duplicate and each direct-connected to a 500,000-gal. Deane pump on one end and an American straight-line 6x7-in. duplex air compressor on the other end.

The plant is arranged so one pump is required to operate part of the day only and not at all during the night, the pressure being maintained through a system of automatic valves by the compressed air in the air-storage tanks. The four cylindrical water tanks on the hill above the pump house are each 8 ft. in diameter, 33 ft. long and have a combined capacity of 50,000 gal. They are built of boiler plates and are designed to withstand safely a hydrostatic pressure of 150 lb. The air tanks are of the same size and construction as the water tanks, but are designed for a pressure of 200 lb. The combined capacity of the air tanks when charged with air at 120 lb. pressure is sufficient to discharge all the water in the tanks at a uniform pressure of 65 lb., while the pumps and air compressors are at rest. Two larger water tanks and two larger air tanks could have been used with the same results and safety of operation, but the size of the four tanks in each case as built permitted them to be completely assembled in the shop and shipped to the site ready to be set up.



Plan of First Floor of Pump House and Air Storage Tanks

The suction of the pumps is connected directly with the wells and they discharge into the water tanks against the gravity head and the air pressure in the tanks. The air tanks are connected with the water tanks by a 2½-in. delivery pipe and the water tanks are connected back to them through the air compressors. The usual method of operation is as follows: The water tanks are normally charged to their full capacity, with the remaining space filled with compressed air, the entire capacity of the tanks being available under the uniform pressure of 65 lb. When the water in the tanks has been drawn down by consumption, one of the engines is started and water pumped from the wells into the tanks; the air compressor drawing air from the water tanks at the same time as the water rises in them and delivering it into the air storage tanks. When the water has reached a fixed level in the tanks, an overflow operates a switch in the pump house automatically, stopping the engine and ringing an alarm bell.

The four water tanks are cross-connected to the same inlet and each tank may be cut out of operation without affecting the others. The connections of the four air tanks are similarly arranged. The pressure in the water tanks is maintained at about 65 lb. by an automatically-operated controlling device in the pump house on the delivery pipe between the air and water tanks, which is operated by two standard valves made by Kieley & Mueller, of New York. One of the valves is a hydraulically-operated throttle valve on the high-pressure delivery pipe from the air tanks to the water tanks. The water actuating it is controlled by a three-way valve connected with the water at the bottom and the air at the top of the water tanks through small pressure transmission pipes. By an arrangement of a pneumatic diaphragm mounted on a lever with a knife edge fulcrum at one end and a counterweight at the other, the three-way valve is made to respond to very slight differences from a predetermined pressure in the storage tanks and thus maintain them at practically uniform pressure. A similar arrangement of pressure-controlling apparatus was illustrated in the description of the Babylon, N. Y., water works in The Engineering Record, Jan. 18, 1901. The connections between the air and water tanks are also arranged with a by-pass enabling the water tanks to be placed under direct pressure from the pumps.

The gas engines are of the vertical self-contained, three-cylinder, four-cycle type, with 9½x 11-in. cylinders. The valves of one of the three cylinders are so arranged that it may be operated independently without affecting the operation of the other two. The engine is started by using compressed air from the air tank in the independent cylinder. Gasoline is supplied from a 10-bbl. tank buried about 30 ft. from the building.

The average consumption per day varies from about 50,000 gal. in the winter to about 100,000 gal. per day in the summer, the village being largely a summer resort. The full capacity of the plant with a single pumping unit is 500,000 gal. per day. During the period of maximum consumption one engine is operated for 1½ to 2¼ hr. a day, while during the winter the amount of pumping is considerably less. The plant is run by an attendant living on the second floor of the pump house who also has charge of the distribution system.

The plant was designed and built by the Acme Water Storage & Construction Co., of New York, Mr. Oscar Darling, president. It is owned by the Nassau County Water Co., of Port Washington.

The Sinking of a Railway Embankment.

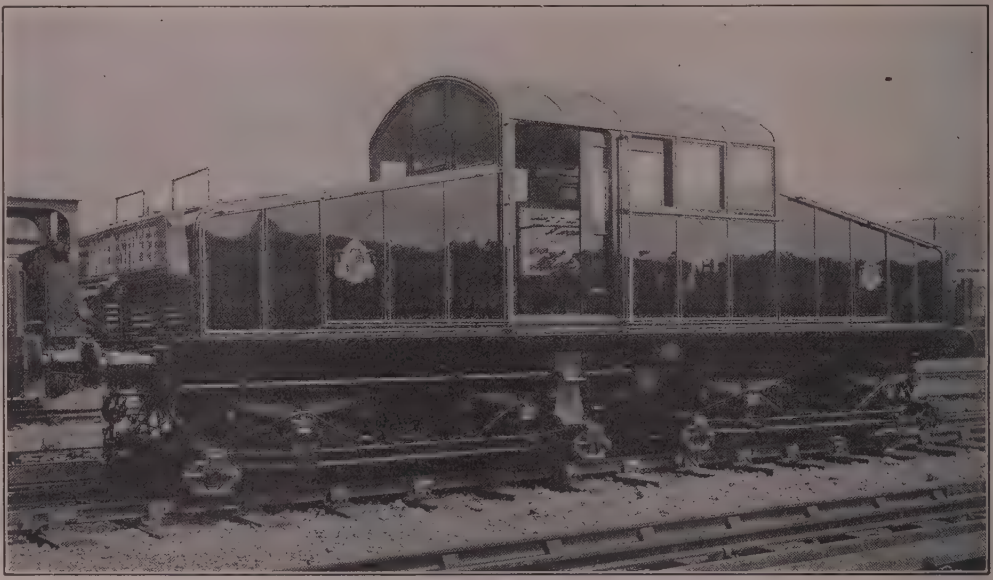
The unexpected sinking of an old embankment on a single-track branch of the Erie R. R. near its connection with the New York, Ontario & Western Ry. between Crawford Junction and Pine Bush, near Middletown, N. Y., occurred a few days ago and gave rise to exaggerated newspaper accounts of what was an unimportant, but curious phenomenon. At this point the track is carried on a 5-ft. earth embankment built more than 30 years ago on the surface of a bog. It has been in constant use for light traffic and had not within many years, if ever, given any trouble or shown any signs of settlement.

On August 8 a ballast train, drawn by a 191,000-lb. locomotive, was unloading cinders there for surfacing the track a few inches for the first time in several years, when the embankment suddenly began to sink under the locomotive and went down so fast that the locomotive nearly capsized and was unable to extricate itself. A second locomotive came to its assistance within an hour or two and stopping about 400 ft. from the first one, also sunk in the same manner. This effectually closed the line temporarily, so a turnout about 600 ft. long was built with its embankment on the ground about 25 ft. from the original line and traffic maintained on it while the locomotives were removed, the pits filled and the original alignment restored. Traffic was then resumed over the old line and no further trouble is anticipated.

The depression at each locomotive was about 100 ft. long with a maximum depth of 3½ ft. The surface of the ground is normally wet and boggy, but there is no record of any borings there nor any available information concerning the depth of the surface soil nor the nature of underlying material. There is no report of recent operations in the vicinity to cause the sinking, and the only theory that has been suggested to account for it is that the present unusually dry season has reduced the large quantity of moisture in the soil and made the bog so friable that when an exceptionally heavy concentrated load remained standing on the track it broke through the crust and caused the porous material to crumble and compress under it.

Electric Locomotives for the Metropolitan Underground Ry., London.

A few weeks ago mention was made of the delivery of the first of ten 150-ton Westinghouse direct-current locomotives to the Metropolitan Ry. of London, and it is now possible to give some further details concerning them. On June 29 the locomotive was coupled to a freight train weighing 279 tons and made a number of most successful trips between Willesden Green and Uxbridge. It has also been tested on the Harrow line between Baker St. and Uxbridge on passanger traffic with equally good results. The ten locomotives will be used for hauling the Great Western trains through the northern part of the Circle between Edgware Road and Aldgate, for conveying the main line passenger traffic from Pinner, Rickmansworth, Verney Junction, etc., between Harrow and Baker St., and also for hauling freight trains over both the Circle and St. John's Wood Line. Owing to the length of the trains and the cramped conditions existing at the termini, it has been necessary to keep the length of the locomotives down to the lowest possible limit. This has been effected by using motors of a smaller sizer than usual and equipped with forced ventilation.



Electric Locomotive of Metropolitan Underground Railway, London.

The locomotive equipment consists of four motors, the normal ratings of which are 200-h.-p. each; but by aid of the forced ventilation, which is supplied by an air blowing set, the motors are rendered capable of developing 250 h.-p. each with perfect safety. The locomotive is also equipped with both the Westinghouse automatic air brake and vacuum brake, and each is coupled to the foundation brake gear in such a way that either may be manipulated and caused to apply the brakes without making any changes whatsoever in the connections.

These locomotives are able to haul a train weighing 170 tons, exclusive of the locomotive, between Baker St. and Harrow at a maximum speed of 36 m.p.h.; and a freight trains of 250 tons, exclusive of locomotive, over the Circle at a maximum speed of 27 m.p.h.

The motors of this locomotive are of the usual series-wound tramway type, and there is nothing novel in the winding. The air is admitted to the motor at a pressure of 4 oz. per square inch, and the mouth of the ventilating duct is so formed as to distribute the entering air over the entire end of the armature and field coils. The cover of the motor is of the ventilated type, so that this air, after it has absorbed the heat from the armature and field coils, passes into the atmosphere.

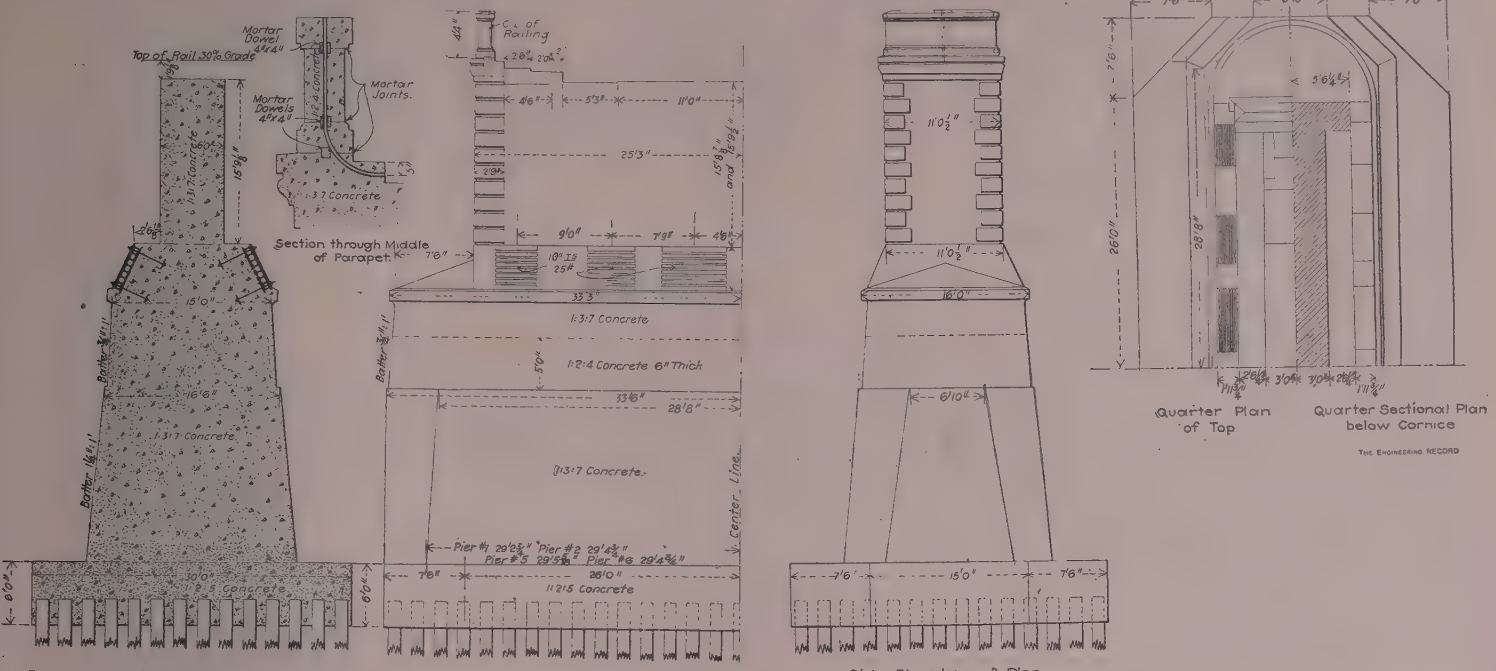
There are four motors with each locomotive, and these are arranged in pairs. Each pair of motors has a separate turret controller of the Westinghouse electro-pneumatic type. These controllers are manipulated by a single master switch and are not of the automatic type. The switches, however, are closed with the step by step method usual with tramway type controllers, this being necessary owing to the vast amount of shunting of freight and passenger trains in sidings.

The average weight on each wheel of the locomotive is 12,550 lb. The blower is fitted with a resistance which can be switched in shunt connection with the field coils, so that the speed may be increased 25 per cent., and the pressure of the air thereby increased from 4 oz. per square inch to 6 oz. per square inch. This arrangement will be used when the motors are working under the most severe conditions of service.

Storm-Water Drains, to serve their purpose, must be provided with inlets which admit water freely yet keep out the rubbish and silt, and the streets must be kept clean. If this latter precaution is not taken the system cannot prove satisfactory. This is well shown in New Orleans. The main drainage system of that city consists at present of about 20 miles of open canals and 20 miles of covered and lined canals with some large screened openings directly into them. Most of the connections between the canals and the street surfaces were laid independently of the commission in charge of the main drainage works. In consequence some of the connections have not been made in accordance with the plans on which the sizes of the canals were computed, surcharging some canals and not utilizing others. The most serious trouble, however, is the fact that trash of every conceivable character, including boxes, barrel heads and planks, blankets the inlet gratings and prevents the running off of the storm water. Unless the people will keep this trash off the streets trouble with flooded streets is bound to result.

The Anacostia Bridge, Washington.—I.

The government bridge now under construction across the Anacostia River or eastern branch of the Potomac River at the foot of 11th St., Washington, D. C., is a steel arch deck structure 1,000 ft. long between face of abutments, about 50 ft. wide over all and with a roadway about 30 ft. above low tide. The location is near the lines of the Pennsylvania and of the Baltimore & Ohio Railroads at a point where the river is navigable with a channel depth of 14 ft. at low tide. The projected channel is 24 ft. at low water for a width of 600 ft. Thence reducing to 80 ft. at the bulkheads 1,000 ft. apart. The axis of the bridge is perpendicular to the approved bulkhead lines and makes a small angle with the axis of an old bridge which intersects it near the north end. The new bridge is at a grade 20 ft. above that of the old one and will have two 6½-ft. sidewalks and a 35-ft. roadway, in which will be laid the double tracks for the electric cars of the Anacostia & Potomac River R. R. Co. The bridge is being constructed by the United States, according to act of Congress of April 27, 1904, at a total cost of about $375,000, and is to be completed by Jan. 1, 1907. It is stipulated that the railroad company must pay for the whole of that portion of the floor system included between two longitudinal lines 2 ft. outside of their track rails. The designs have been made in the office of Mr. W. J. Douglas, engineer of bridges, under the direction of Col. John Biddle, U. S. A., Engineer Commissioner, and Capt. J. J. Morrow, U. S. A., assistant to the Engineer Commissioner, of the District of Columbia. The contract has been



Section through Middle of Parapet.

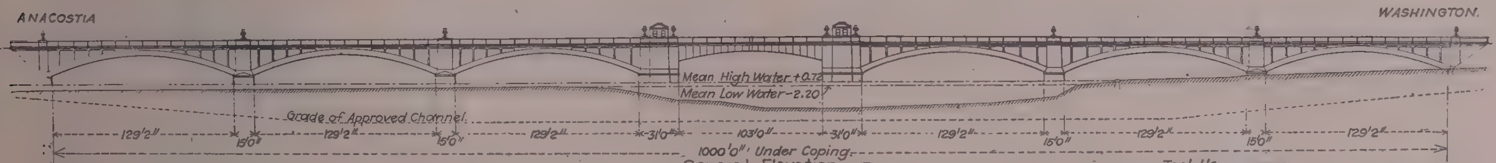
Transverse Section through Center of Pier

Half End Elevation of Pier

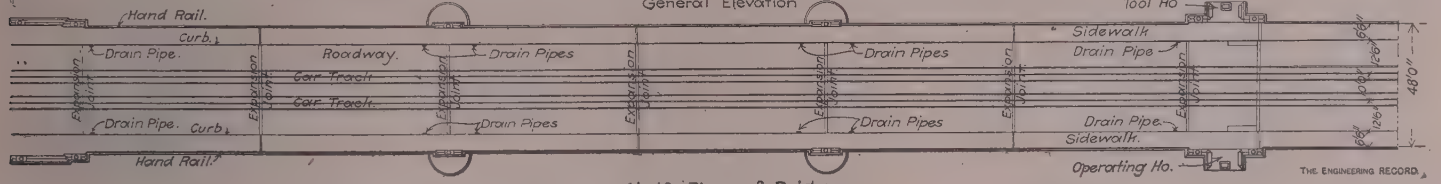
Side Elevation of Pier

Quarter Plan of Top

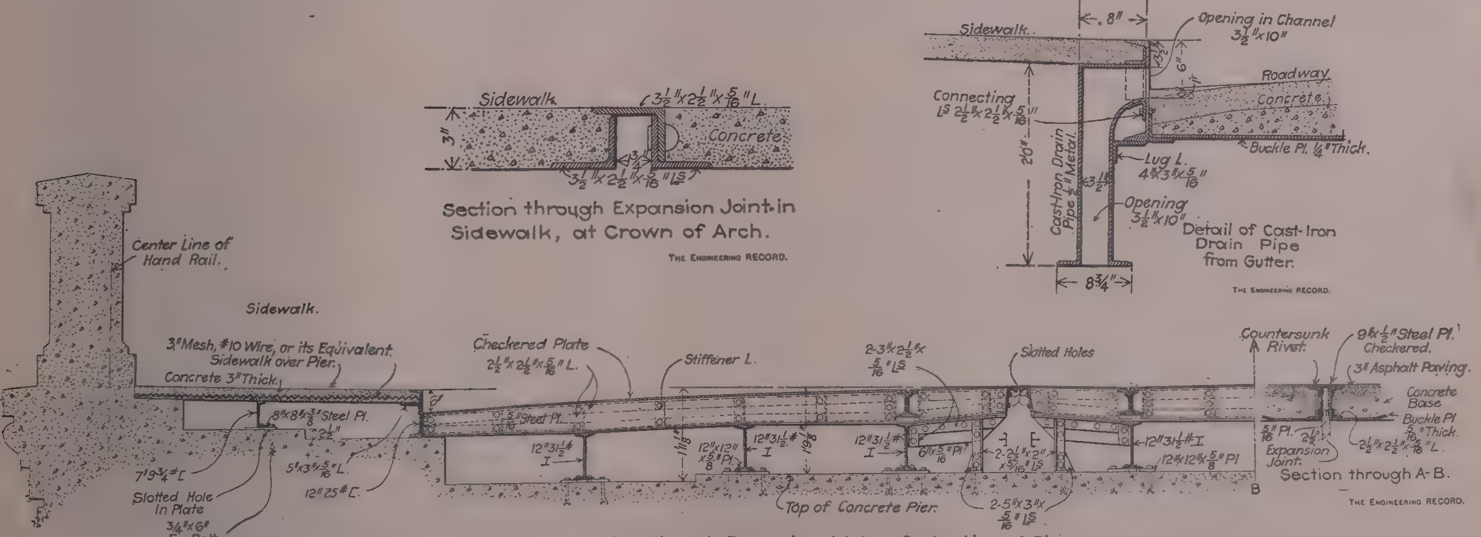
Quarter Sectional Plan below Cornice



General Elevation



Half Plan of Bridge.



Section through Expansion Joint in Sidewalk, at Crown of Arch.

Detail of Cast-Iron Drain Pipe from Gutter.

Section through A-B.

Section through Expansion Joint on Center Line of Pier

Some General Details of the Anacostia Bridge at Washington, D. C.

awarded to the Penn Bridge Co., Beaver Falls, Pa., and work is now in progress on the substructure.

The bridge has two abutments and six intermediate piers of concrete with pile foundations which support six plate-girder arches, each with six segmental ribs of 129-ft. 2-in. clear span and 14½-ft. center rise. There is also a bascule draw of 103-ft. clear span between center or channel piers. The leaves of the bascule are operated by electricity and are supported on plate-girder cantilever arms with curved lower chords. This span has a wooden floor; elsewhere the floor is of concrete asphalt on solid steel buckle plates. The bascule span is designed so as to permit the future replacement of the wooden floor with one of asphalt and steel buckle plates. The stringers and floorbeams are proportioned to carry on each track one 40-ton car with two trucks having 4-ft. axles 5 ft. long and on the roadway a 20-ton roller with two axles 10 ft. apart, the front axles carrying 6 tons and the rear axles 14 tons, roller 6 ft. wide. The sidewalk stringers are proportioned for a load of 90 lb. per square foot and the main cantilever girders in the bascule are each proportioned for concentrated loads of 14 tons at every panel point. The maximum unit stresses allowed are 15,000 lb. per square inch tension and 15,000 lb. per square inch compression, reduced by the formula

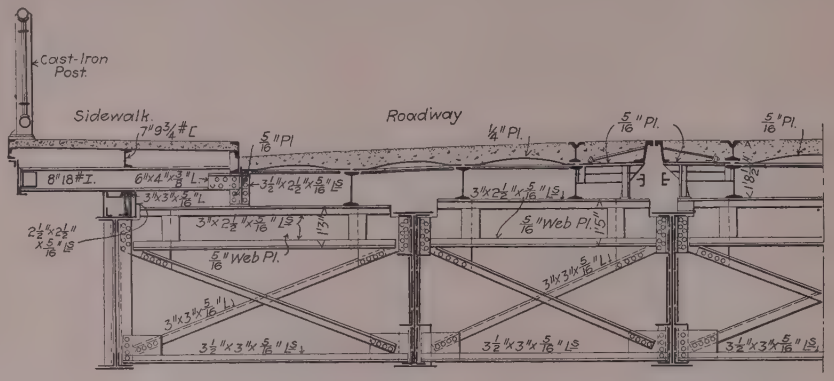
$$P = \frac{15{,}000}{1 + \dfrac{l^2}{13{,}500\, r^2}}$$

in which P equals the allowable pressure per square inch, l equals length in inches, and r equals least radius of gyration in inches, for stresses conforming with Cooper's highway bridge specifications of 1901. The machinery is required to withstand a wind pressure of 25 lb. per square foot on the lower surface of the bascule, and to lift the draw within 1 minute under a wind pressure of 10 lb. per square foot of floor surface, both pressures being assumed to act at the greatest disadvantage.

Substructure.—When the work was commenced the depth of water at low tide was about 14 ft. at one of the center piers and from 6 to 10 ft. at each of the two adjacent piers. At the other piers the bottom was nearly or quite exposed at low tide and the river is subject to an average tide of about 3 ft. Three test holes were sunk to depths of from 45 to 51 ft. below low-water level in the axis of the bridge, as shown on the diagram, and indicated that the bottom is composed of alternate layers of sand, gravel, mud and clay, in which it was determined to drive the piles to satisfactory refusal in the clay or gravel and to carry the concrete to a depth of 23 to 31 ft. below mean low water. Six preliminary test piles were driven, as indicated in the general elevation, and showed the following results, the depths given being the approximate distances to which the pile points were driven below mean low water and the penetration in inches and the drop in feet referring to the last blow given with the 2,800-lb. hammer. Pile No. 1, depth 59, drop 45, penetration 1½; Pile No. 2, depth 63, drop 40, penetration 1¼; Pile No. 3, driven with 15-ft. follower, depth 63, drop 31, penetration 5/16; Pile No. 4, depth 53, drop 42, penetration ⅞; Pile No. 5, driven with 20-ft. follower, depth 56, drop 25, penetration ¾; Pile No. 6, depth 55, drop 40, penetration 1¾.

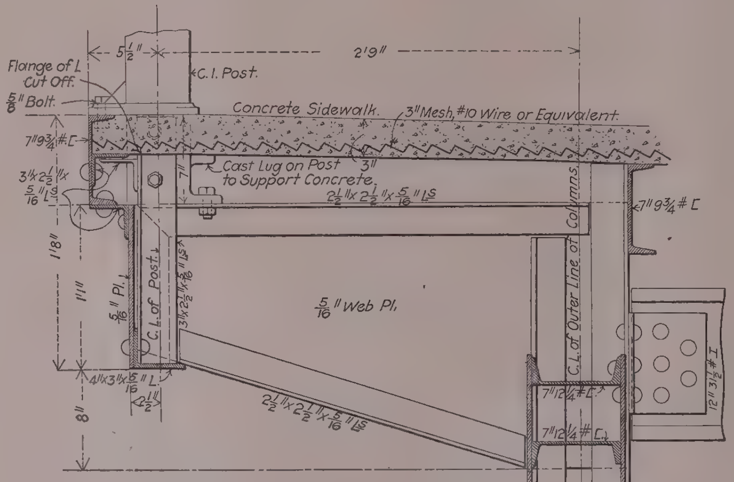
At the site of each pier and abutment when the bottom has been dredged to the required depth and where the material is soft, sand will be filled in to a depth of 2 ft. around the tops of the piles to form a bed for the concrete. The piles are designed to take a maximum load of 15 tons each and are pine or oak 12 in. in diameter at the butt and most of them 40 ft. long after being cut off. It was required that they should be driven to a refusal of ⅓ inch under a 15-ft. drop of a 2,000-lb. hammer. In each of the six piers there are 410 or 420 piles and in the north and south abutments there are respectively 258 and 405 piles, a total in all of 3,087.

The substructure in all cases consists of monolithic concrete carried up to subgrade for the roadway and extended above that on the sides of the bridge to form the parapet walls which are



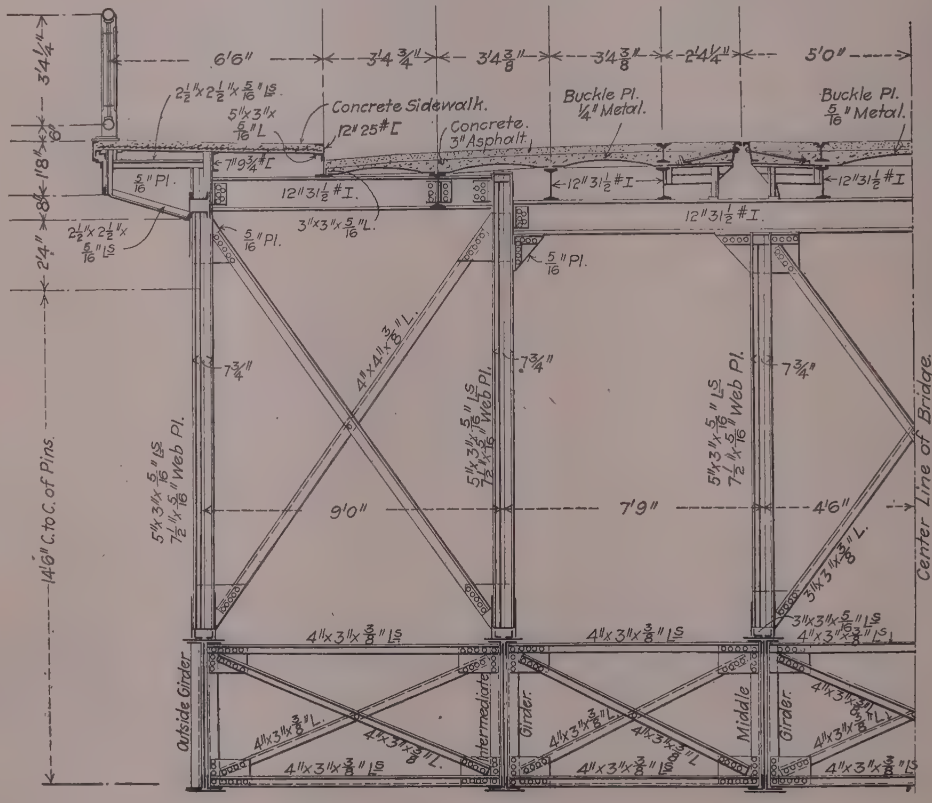
Section through Sidewalk and Roadway at Panel Point No.7

THE ENGINEERING RECORD.



Section through Fascia Girder and Sidewalk.

THE ENGINEERING RECORD



Section through Sidewalk and Roadway at Column No.1.

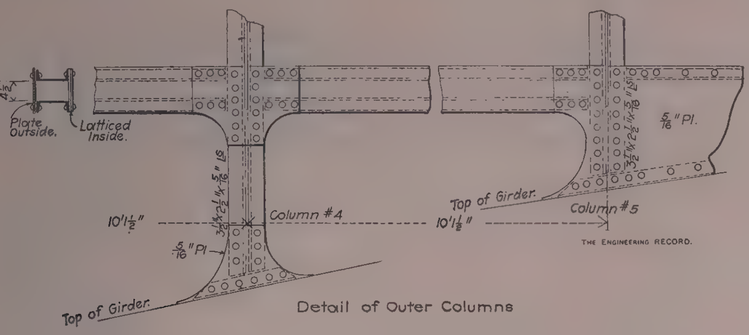
THE ENGINEERING RECORD.

General Sidewalk and Roadway Construction.

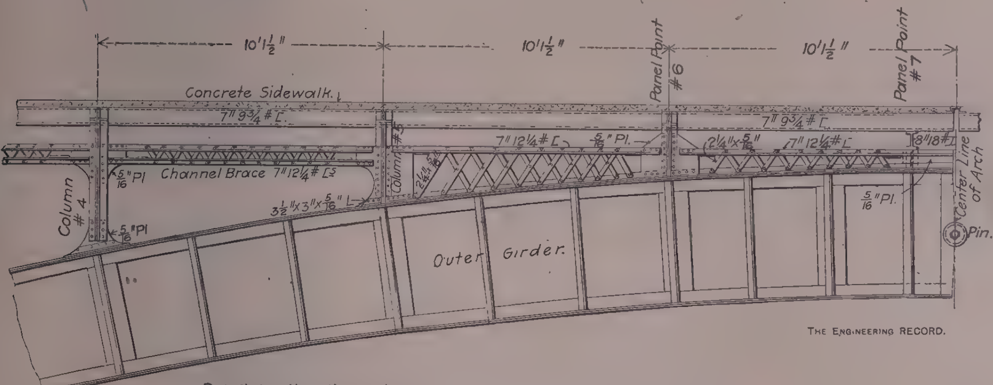
not built continuously with the lower part but are keyed to it and keyed together as shown in the details. Both abutments form in plan three sides of a rectangle with vertical faces and offset their walls extended at the base to resist the thrust of the earth fill. The piers for the draw span are about 31½ ft. wide, 64 ft. long at the base and 55 ft. wide above the tops of the piles. They are rectangular in plan and are chamfered to receive the buckle plates and the machinery for operating the bascule leaves. The remaining four intermediate piers are essentially duplicates of the one illustrated and are being built in forms constructed in cofferdams made of tongue-and-groove sheet piling driven around the foundation piles and subject to complete removal or to be cut off to 1 ft. below tide two months after the completion of the concrete. The piers are made of Portland cement concrete proportioned 1:3:7 except in the footings, which are made 1:2:5. After the piles are driven, the necessary filling around their tops is made with sand which does not contain more than 20 per cent. of silt and is carefully leveled to a height of 30 in. below the pile tops, which are sawed off square by a submerged circular saw. The footing concrete is then deposited under water around the pile heads by means of a steel tremie pipe with flexible joints. After this concrete has set 48 hours or more, it forms the bottom of the cofferdam, which is then pumped dry so that molds may be constructed and braced in the usual manner for the piers.

The sand is carefully selected to contain both fine and coarse grains and not to have more than 6½ per cent. of silt or other foreign matter. The size of the broken stone and gravel varies with the different classes of concrete, but in all cases the former is the run-of-crusher and is passed through a ring of 1 in., 1½ in., 2 in. or 2½ in. diameter.

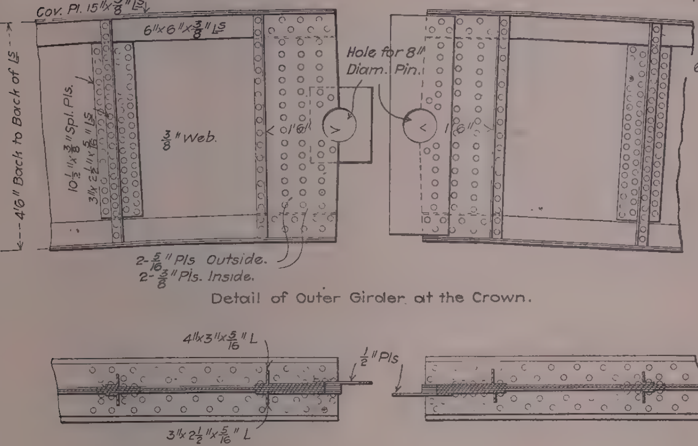
On each intermediate pier 12 sets of I-beam grillages in inclined planes are bedded in the concrete to form supports for and distribute the pressure from the skewback shoes of the superstructure. Each grillage is made with eight horizontal 10-in. I-beams weighing 25 lb. per linear foot and bolted together with two lines of standard cast-iron separators. Just above water level the battered surfaces of the piers are finished with a belt of 1:2:4 concrete 6 in. thick and about 5 ft. high, which is intended to resist impact from floating particles. The piers are built without reinforcement except those for the bascule span, which have two pairs of 1-in. horizontal steel bars 12 in. apart 3½ ft. above the pile tops. In these piers also there are platforms of I-beams built into the base of the masonry to anchor the superstructure.



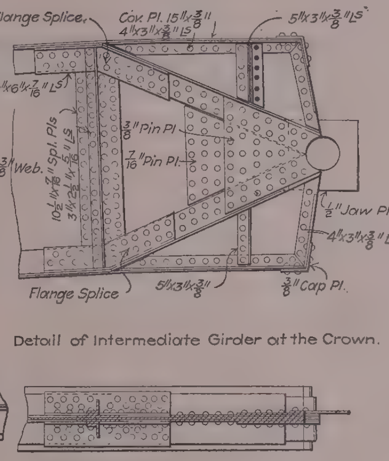
Detail of Outer Columns



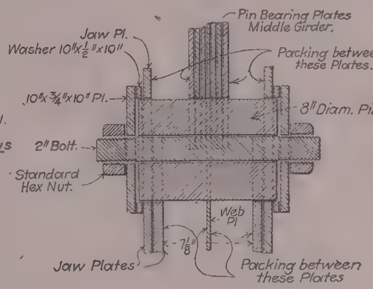
Detail Section through Outer Columns and Channel Brace, showing Connection to Top of Outer Column.



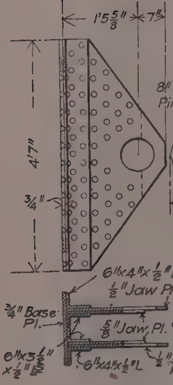
Detail of Outer Girder at the Crown.



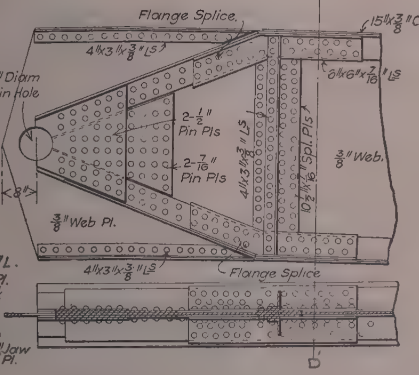
Detail of Intermediate Girder at the Crown.



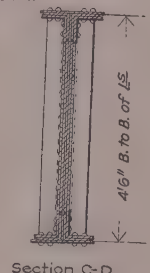
Section through Center Line of Pin.



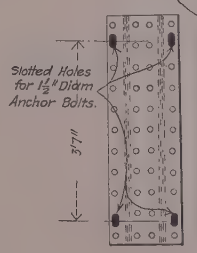
Detail of Shoe.



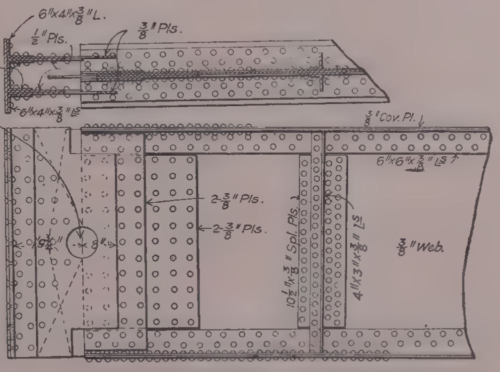
Detail of Intermediate Girder at the Shoe.



Section C-D



Detail at Shoe.



Detail of Outer Girder at the Shoe.

THE ENGINEERING RECORD

Details of Columns and Arch Ribs of Anacostia Bridge.

Arch Spans.—Each of the six fixed spans has six three-hinge plate-girder arch ribs spaced 4 ft. 6 in., 12 ft. 3 in. and 21 ft. 3 in. from the axis of the bridge. Each rib is made with two semi-arch girders 4½ ft. deep with parallel flanges, the lower one curved to a radius of 147 ft. The span from the center of the skewback pins is 128 ft. 4½ in., and has a rise from center of skewback pin to center of crown of 14 ft. 6 in. The distance in a straight line between the skewback and crown pin is 65 ft. 10 5/32 in., allowing for camber. A deflection of ½ in. is calculated for the dead load of the bridge and ⅜ in. for the maximum uniformly distributed live load. The vertical displacement of the crown pin under a variation from the normal of 75° temperature is 1⅜ in. Beginning at a point about 3½ ft. from the skewback pins the span is divided into twelve 10-ft. 1½-in. panels and at the panel points supports are provided for the floor system. These supports are vertical spandrel columns at the end of the arch and between them there is in the center and two outside panels of each transverse plane X-bracing of single angles at the first and second panel points. At all panel points the girders are braced together with horizontal and X-brace angles in all the panels of the transverse radial cross-section. A system of lateral angles is provided throughout the span in the plane of the lower flanges of the girders between the two outer girders and between the two center girders, making three sets for each span and omitting these braces in the two longitudinal panels of each span. Additional lateral stiffness is provided by the continuous floor and steel buckle plates ¼ in. thick riveted to the top flanges of the stringers and floorbeams, as shown in the cross-section.

The outer girders correspond with the inner intermediate girders in general dimensions and design but differ from them in details and materials. The outer girders have lighter loads and are made with less sectional areas and are modified at their bearings and in relation to the floor system to provide the required effect for the general elevation and to correspond with the fascia girders in the roadway. They are made with two 6 x 6 x ⅜-in. angles and one 15 x ⅜-in. cover plate continuous for the full length of each flange and have ⅜-in. web plate which at the ends is cut square so as to engage a special skewback shoe and presents the appearance of full width bearing on the masonry. At the crown the abutting ends are slightly beveled to afford clearance for temperature movements and the joint is covered by a single rectangular plate on the outside which gives the appearance of continuity and solidity and disguises the joint. In the two panels each side of the crown a solid plate in the plane of the web extends from the top flange to the lower edge of the fascia girder so as to give an external appearance of solidity. In other respects the outside girders correspond with the inner ones. The intermediate girders are made with 6x6x7/16-in. flange angles with single 15 x ⅜-in. coverplates, ⅜-in. web plates and heavy bars of 4 x 3 x ⅜-in. web stiffener angles at the main panel points and pairs of 3 x 3 ½ x 5/16-in. web stiffener angles intermediate between them. The center girder differs slightly in that there is one 15 x ½-in. top flange coverplate and one 15 x ½-in. and one 15 x ⅜-in. bottom coverplate. In the middle and intermediate girders the flange angles are of the same span and inclined angles of the same size and connect with the web extending from the ends of the flange angles to intersection at the center of the hinge pin. These angles are spliced with bent cover plates and the web between them is reinforced by several thicknesses of coverplates proportioned to provide adequate bearing on the pin. All pins are 8 in. in diameter; those at the crown lock the girders on both sides together through full bearings in small outside plates. Those at the skewback lock the girders to the shoes through the hole in the center web plate and through holes in the outer web plate's pedestals. Excepting these plates, all of the other bearing plates have half holes for the pins. The pins have holes bored in the axis to receive 2-in. bolts with nuts at both ends engaging steel discs and shoes which cover the square ends of the pins. Each shoe has through its base plates four slotted holes for 7½-in. anchor bolts 4 ft. long which pass through the grillages and engage 12 x 12-in. reaction plates bedded in the masonry. The shoulders are seated on the grillages with rust joints made with one part sal ammoniac, one part flour of sulphur and 100 parts cast-iron borings thoroughly tamped. The spandrel posts have I-shape cross-sections made with four angles and a web plate and riveted at the bottom to connection angles on the top flange of the girder. At the tops of the outer girder posts the flange plates form jaws receiving the ends of horizontal struts just below the roadway level. The posts are alike for all girders except that those for the outer girders have the edges of the connection plates curved. The posts on the intermediate girders have horizontal caps receiving the 12-in. floorbeams, of the center girders and the buckle plates for the intermediate girders. The floorbeams carry 12-in. longitudinal stringers supported by web connections, all seated on the top flanges, as shown in the typical cross-sections. The center of the sidewalk is nearly coincident with the outside girders and a portion of the sidewalk, together with the hand rail, is cantilevered beyond the girders with brackets and solid web plates are riveted between the angles of the spandrel posts and form integral parts of the post webs. The outer ends of these brackets are connected by a light fascia girder with Z-shape cross-section and special end vertical angles providing rigid connections for the cast-iron hand-rail posts. The hand rail is made with 3-in. horizontal top and bottom pipes about 3½ ft. apart vertically, with 2-in. channels connected to them to receive the ⅝-in. square vertical bars about 5 in. apart. These bars are connected by a flat steel bar about 6 in. each side of the center, dividing the railing into small rectangular panels.

The buckle plates in the roadway floor are made in long strips and spliced together at all joints and covered with two coats of paving cement. They are leveled up to a height of 2 3/16 in. above the highest point with 1:3:8 Portland cement concrete on which is an asphalt pavement. The sidewalks consist of flat concrete slabs made in two thicknesses, the lower one 2 in. thick is made 1:2:4, and the 1-in. upper part is made with 1:1½ mortar reinforced by a continuous sheet of No. 10 wire mesh. The roadway is crowned transversely, as shown in the cross-section at the pier, where the stringers are supported directly on the masonry. This view shows the construction of the rails and slots for the electric car tracks and the double curved girders confining the roadway materials at the ends of the span, where an expansion joint is provided and covered with a checkered steel plate riveted to one girder and sliding freely on the top of the other. The joints at each of the draw piers are similar, except that the stringers are seated on adjacent shim plates on the top flanges of transverse plate girders. At each of the intermediate piers drainage is provided through special vertical cast-iron pipes fitted to the girders under the edge of the sidewalk, as shown in the detail.

The estimated quantity of steel in the bridge is about 3,630,000 lb., including machinery. The draw span and machinery weigh 761,000 lb., exclusive of flooring, and each of the regular spans weighs 446,500 lb. The semi-arch girder ribs will be shipped complete from the shops and will weigh from 7 tons for the outer to 10½ tons for the middle girder. The estimated amount of concrete in the substructure is 15,450 cu. yd.

(To be continued.)

The Rome and Civita Castellana Ry., which will be operated by the Westinghouse single-phase system, is 33½ miles long with many stiff grades. The 2½-mile section between Rome and Ponte Milvio, where the power house will be located, will be operated at 550 volts and the remainder at 6,000 volts. The equipment will be essentially like similar American installations.

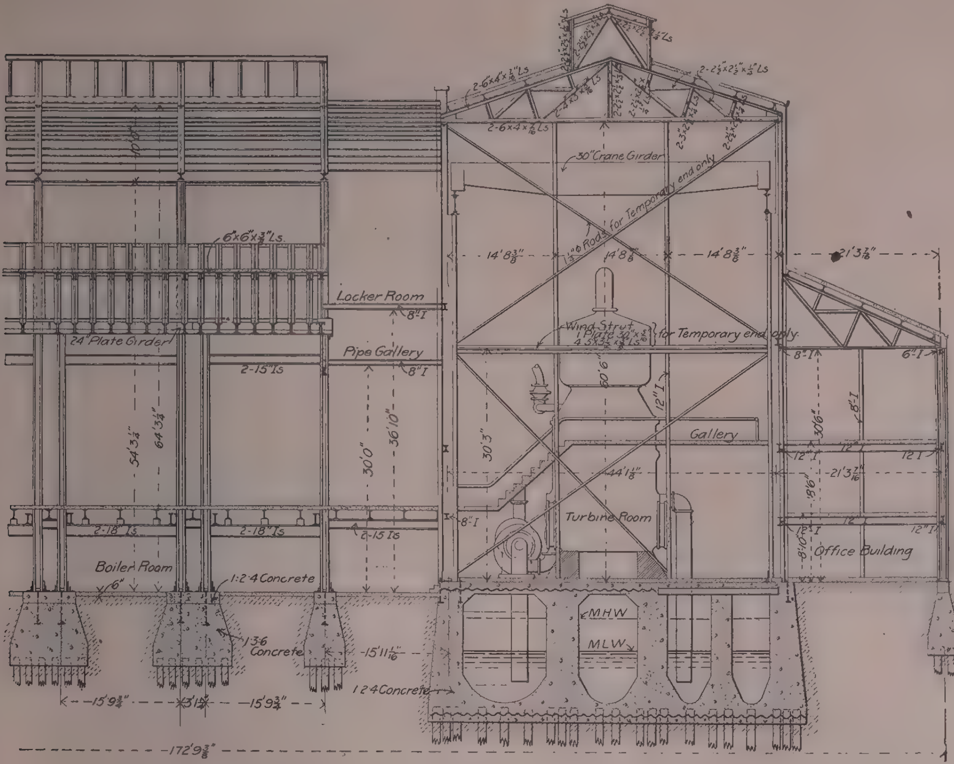
Steelwork of the Marion Power Station, Public Service Corporation of New Jersey.

The Marion power house, on the east bank of the Hackensack River, in Jersey City, is designed for an installation of boilers and Curtis turbo-generators of about 64,000 k.w. ultimate capacity, and is a part of the system of the Public Service Corporation of New Jersey. At the present time one-fourth of the station has been constructed. It is a brick and steel building about 75 ft. high, 173 ft. long and 156 ft. wide with steel framework carrying roof, walls, floors, coal bins and equipment. The framework is structurally in two parts, the 107x155-ft. boiler house and the 65x155-ft. turbine room with their axes at right angles to each other. Both have double-pitched roofs with flat slopes and ventilating monitors extending nearly from end to end on the center line. The boiler room has a single story with a concrete floor. The boiler room is separated from the turbine room only by the row of columns common to the division wall; it has a basement story, a high main boiler room story above it, and all the space between the latter and the roof is occupied by coal storage bins and conveying apparatus. The balcony on the south side of the turbine room is formed by the 3-ft. projection, on column brackets, of the third floor, 18½ ft. above the ground, of a three-story lean-to annex for offices and switchboards on the outside of the turbine room.

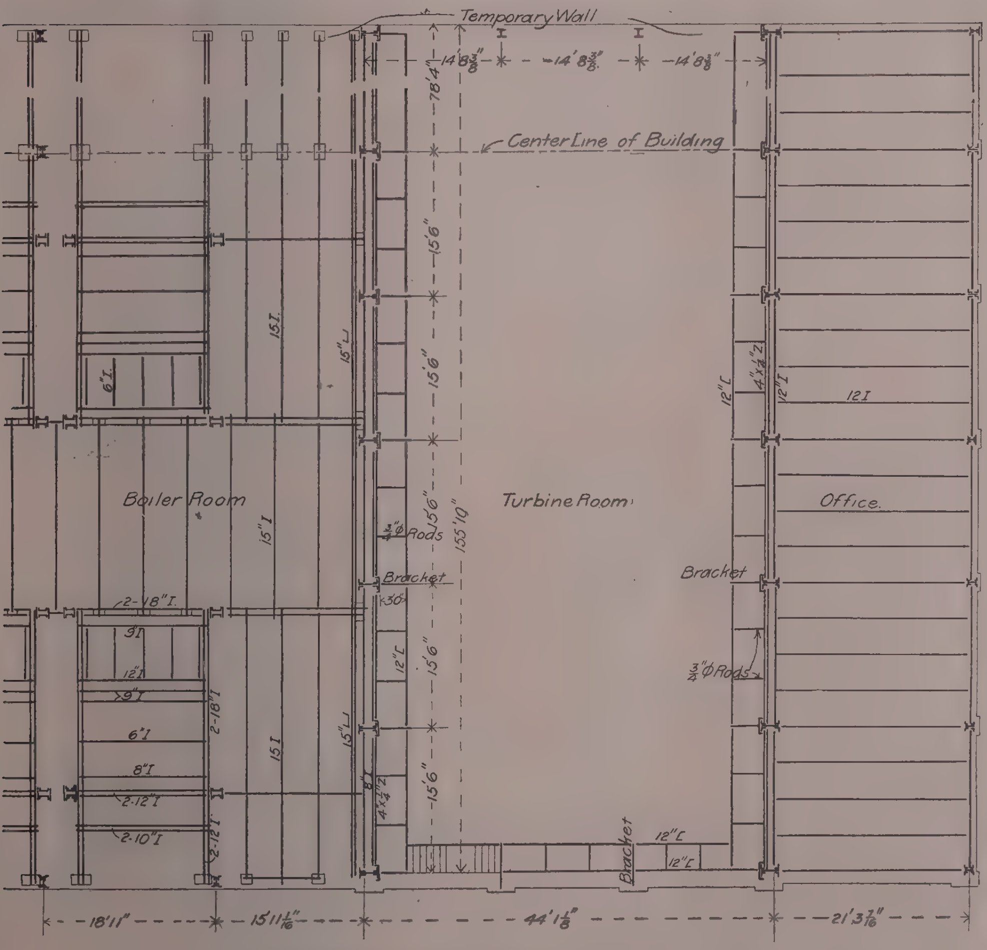
There are 70 main columns, 50 of which are in the boiler room, and are arranged in six transverse and 11 longitudinal rows, from about 15½ to 19 ft. apart. The columns directly supporting the boilers are twin columns with rectangular closed cross-sections made up with a pair of channels and two coverplates and seated on single foundation piers. All the other columns in the boiler room and in the turbine room have I-shaped cross-sections with a web plate and four flange angles, and are seated on separate foundation piers. The main columns for the turbine room are 15½ ft. apart in the side walls in two longitudinal rows about 44 ft. apart, one row being also in the end of the boiler room.

The second or main floor of the boiler room has a wide aisle on each side of the center longitudinal line, and on each side of each aisle there is a row of five 600-h.p. Babcock & Wilcox boilers, twenty in all. Each boiler setting is supported on an independent panel of floor beams and girders carried by six columns. These columns are in transverse rows 15 ft. 9¾ in. apart in each setting, but only 3 ft. 1¼ in. apart on centers for the adjacent groups, so that they become twin members on the same piers. For each boiler the framing is like that shown in one panel of the floor, and in the aisles and between the boilers and the turbine room the framing is of simple transverse beams. In the aisles and other open floor spaces these beams carry concrete floor slabs on their top flanges. The plan of this floor of the building is symmetrical about the center longitudinal line and the beams and girders are all single and double I-beams except the fascias of the turbine room balconies, which are channels.

Symmetrically arranged on opposite sides of the longitudinal axis of the boiler room are two coal bins at a clear height of about 22½ ft. above the boiler room floor. Each bin is about 59 ft. wide and 91 ft. long over all on top and has a W-shaped cross-section, as shown in the transverse section of the boiler room. The framing for the bottom and sides is very simple and consists entirely of pairs of channels riveted together, back to back, with connection plates between and inclined 45 deg. with the horizontal. These channels are supported directly on the tops of longitudinal plate girders carried on the two center rows of columns, and by transverse horizontal girders made with similar pairs of channels, which connect the girders in the planes of the inclined members, about 2½ ft. apart. The upper ends of the side wall members are supported by inclined braces from the side columns, so that each transverse bent of framing consists essentially of three triangular frames. The vertical end walls of the bins are made with 8-in. I-beams framed into a 15-in. horizontal channel on top. The inner surface of the bin and the floor of the adjacent locker room are made of flat concrete slabs 6 in. thick.



Part Longitudinal Section of Boiler Room and Transverse Section of Turbine Room.

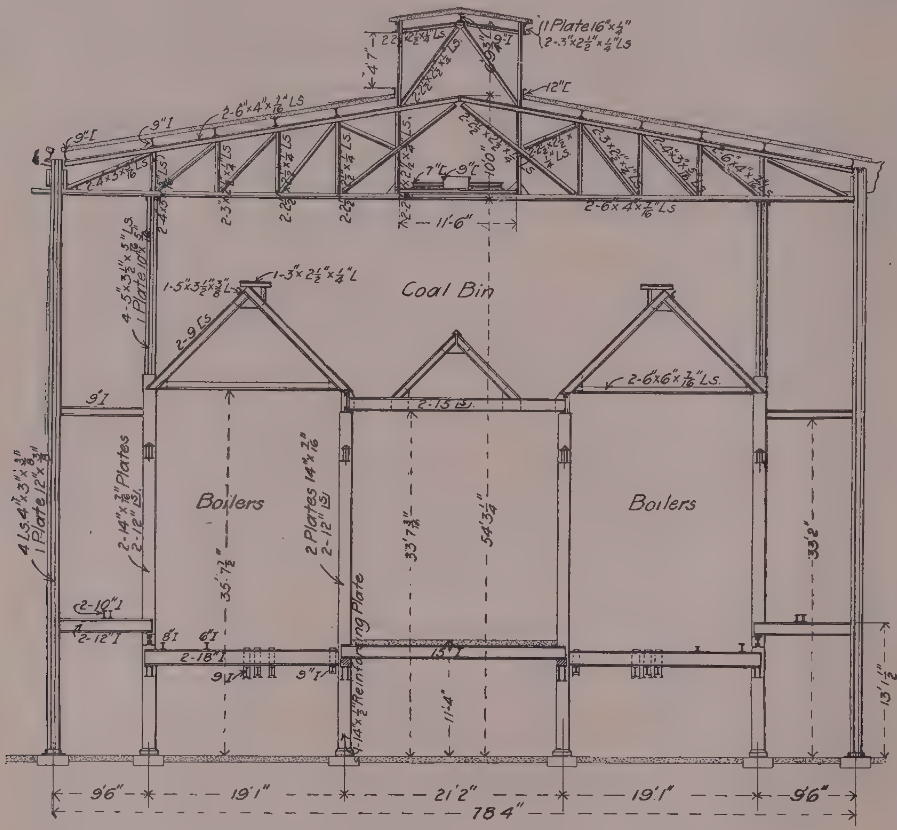


Part Floor Beam Plan, Boiler-Floor Level, Marion Power Station.

The riveted roof trusses are about 8 ft. in the clear above the coal bins and are about 77½ ft. long and 10 ft. deep over all, with a special center panel designed to furnish clearance under the diagonals for the two lines of coal conveyors with a foot walk between, supported on the reinforced lower chords of the trusses. The trusses appear to be supported at four points of their lower chords; in reality their principal supports are 59 ft. 4 in. apart, on the caps of the intermediate columns, at the first panel points from the ends of the trusses, and the end panels cantilever beyond these columns to connect, for lateral stability, with the center and outer columns in the building. The top chords of the trusses are connected by 9-in. I-beam purlins, about 6 ft. apart, and by X-bracing of ¾-in. pin-connected rods in every panel, except one panel at each end. The purlins and the monitor frames carry concrete roof slabs and the glazed sides of the monitors are pivoted on horizontal hinges to afford convenient ventilation. The roof over the turbine room is similar to that over the boiler room, and is carried on light riveted trusses 15½ ft. apart, which are seated with their lower flanges bearing on the caps of extensions of the main columns above the crane runway girders.

The site of the power house is a tidal flat with the surface originally about 1 ft. above ordinary high water and covered with grass. The soil is a low-grade peat mixed with clay to a depth of about 25 ft., where there is a stratum of sand about 5 to 10 ft. thick with black sand, clay and mud underneath. The foundations are entirely on piles 40 to 55 ft. long, which were driven by three pile drivers with 3,000-lb. hammers. Each of the two Custodis stacks, 225 ft. high, has an estimated weight of 2,250 tons, and is supported on 225 piles. The piles were driven through the peat and sand and 15 to 20 ft. into the mud and blue clay. The driving was very irregular, some piles coming to a satisfactory refusal at a moderate depth, and others penetrating so easily that they were driven 10 ft. below the surface by a follower, but developed abundant bearing strength after a few hours.

The site was crossed by a small creek, which was first diverted and then a levee was built along the water front, the flow of the creek being regulated by a tidal gate about 2 ft. square. The pile-driving took about three months, but as soon as one section was completed the earth was excavated around the piles and the foundation piers were built in open pits about 6 ft. deep, which were remarkably free from water and needed little or no pumping. The footings were made with 1:2:4 and 1:3:6 concrete made with Vulcanite Portland cement and mixed in a Ransome concrete mixer located on a tower where all materials were delivered by lighters. The mixing machine discharged into a box with chutes delivering to wheelbarrows by which the concrete was distributed on platforms above the tops of the piers. Two crossed layers of Ransome twisted steel reinforcement rods were bedded in the concrete just above the pile tops. The turbine room was enclosed by 4-in. sheet piling temporarily braced by 50-ft. piles used as rakers, 8 ft. apart, and was excavated to a depth of 16 ft. The concrete floor was reinforced by 1-in. twisted steel rods 3 ft. apart, near the top and bottom surfaces. Excavation was done by hand on a vertical transverse breast, reaching to sub-grade. The spoil was shoveled into ¾-yd. steel tip buckets handled by the boom of a traveling derrick with track on longitudinal rows of piles. The buckets delivered to cars, which were hauled to where the material was used for grading. At the river end of the building a sheet pile cofferdam has been built for the construction of the concrete screen chamber for the condensation water intakes. These consist of five riveted steel pipes 54 in. in diameter and 70 ft. long, which are bedded solid in the concrete at the shore end and have one joint, outside the cofferdam, which will be made by a diver and will allow the river end to be adjusted by means of guys. The end of the pipes terminate in 90-deg. bends, with the face of the vertical portion about 6 ft. above the bottom of the river. The hot water outlet will be through a canal parallel and adjacent to the inlet pipe. It will be 12 ft. wide and will have side walls of 12x12-in. sheet piles without tongue-and-groove. After the piles are driven the excavation will be made by a scraper, which consists of a heavy horizontal timber about 11 ft. long and 2 ft. wide, with a steel plate cutting edge on the bottom and old rail counterweights to sink it. Steel wire bridle ropes will be attached in front and behind, adjusted to give it a satisfactory inclination from the vertical and will be operated by a Mundy hoisting engine to pull it back and forth between the side walls.



Transverse Section Through Boiler Room.

The structural steel was delivered partly by water and partly by rail, with a material track from the railroad siding. It was erected by a traveler which consisted of a stiff-leg derrick on top of a wooden tower about 20 ft. high. The derrick was fitted with Terry patent irons and was operated by a double-drum, double-cylinder Lidgerwood hoisting engine with latest improved swinging device. Erection was commenced at the turbine room end of the west boiler room, and the traveler returned backwards through the east boiler room to the turbine room and erected its framework at right angles to that in the boiler room, thus making five movements for the traveler. All field rivets were driven by Chicago pneumatic hammers operated by air from an Ingersoll-Sergeant compressor run by a Hornsby-Akroyd kerosene oil engine manufactured by the De La Vergne Refrigerating Machine Co.

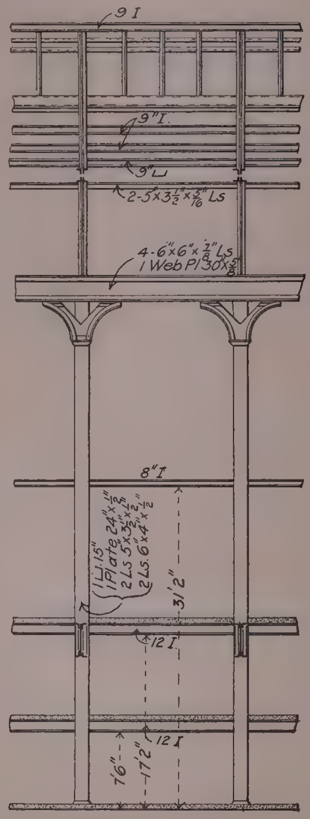
The power equipment is arranged in independent sections, each having ten boilers, two 5,000-k.w., 25-cycle, three-phase Curtis units for railway service and two 3,000-k.w., 60-cycle units, for lighting circuits. There will be a 225-ft. Custodis stack for each double row of boilers, and a stack of smaller diameter for the single row of boilers at each end. No economizers or stokers will be used. There will be two surface condensers for each 5,000-k.w. unit and one for each 3,000-k.w. machine, all of the steam-driven type made by the Wheeler Condenser & Engineering Company. Cochrane open feed-water heaters made by the Harrison Safety Boiler Works will be used.

Mr. J. T. Whittlesey, Newark, N. J., chief engineer of the electrical department of the Public Service Corporation, designed the station, and Mr. W. W. McKee is the mechanical engineer in charge of the construction. The general contractor is the F. D. Hyde Co. The structural steel was fabricated at the Pencoyd plant of the American Bridge Company, and was erected by the Terry & Tench Construction Company.

An Efficient Fire Barrier was recently instrumental in limiting to comparatively small proportions the damage from a fire which attained considerable headway in the garbage disposal plant operated by New York Sanitary Utilization Co., on Barren Island, New York harbor. The 80x150-ft. three story building is entirely of wood. The third floor was made with 4 in. of crossed planks on steel I-beams and was sheathed on the under side with thick sheet steel plates nailed to it between the top flanges of the beams. On the morning of Aug. 7 a fire broke out in the upper story and soon became so fierce that it was impossible to approach close enough to fight it to the best advantage. The entire roof and sidewalls down to the floor were consumed and the fire ate through the walls below the floor in many places but the floor itself was saved by the steel plates and the fire was finally extinguished by the company's fire brigade, who played twenty high pressure streams on it. The contents of the building were so little damaged that work in the lower story was resumed the same day and only a few days' delay was occasioned to the operation of the conveyors in the upper stories. The owners feel that the escape was a fortunate one and that it was chiefly due to the protection afforded by the steel ceiling sheathing, without which the prompt and efficient hose service would probably have been useless.

Pressure in City Water-Works from Fire Protection View-Point.

Few subjects are attracting more attention from water-works superintendents and fire insurance engineers than the pressure in street mains. The two interests are not in accord on all features of the subject. A high pressure in the mains means an increased waste from leaking street mains and plumbing, and one of the most effective means of checking waste is to reduce the street pressure. On the other hand, the higher the pressure the better the fire protection. In any impartial discussion of the subject it is necessary to consider both sides, and for this reason attention is called to a report by Mr. E. G. Hopson, chief engineer of the Committee of Twenty of the National Board of Fire Underwriters. This is a long document, but the following abstract gives its leading features:



Elevation of Panel.

Low Pressures—below 45 pounds—sufficient for fire engine or pump supply, but inadequate for other service except to a very limited extent or in very low buildings.

Medium Pressures—45 to 70 pounds—sufficient for moderate streams for inside work in buildings up to from 3 to 4 stories with moderate length of hose, also for sprinkler supply in buildings of small to medium height.

High Pressures—70 to 100 pounds—fairly effective streams through hose lengths up to 300 feet, giving excellent auxiliary service to fire department, fully adequate for sprinklers in all but buildings of excessive height.

The extended use of sprinkler equipments in mercantile sections should be encouraged and enforced not only in a few of the biggest mercantile and warehouse buildings, but in great numbers of the medium sized to large hazardous risks, especially those closely associated and exposing other buildings in congested city blocks. In every large city are numbers of buildings such as these, of moderate size, but of highly combustible types, crowded with goods of an even more combustible nature, and in all respects constituting conflagration breeders. Such buildings often do not loom up on the insurance map as very conspicuous features and frequently would be passed by as comparatively mild cases, but as a matter of fact they are centres of serious hazard by reason of their nature, location and association, and can only be effectively treated by sprinkler protection.

There is no doubt that great numbers of equipments could be introduced in buildings of this class to the very great reduction of the general hazard, and a line of policy that will tend to remove some difficulties in the way of their adoption must be a wise one. The whole problem is largely one of economics. As matters stand to-day it might be difficult in specific cases to prove to the satisfaction of an owner that a sprinkler equipment would pay for itself by a reduction of insurance rates in view of the present high cost of both installation and maintenance, but if a material reduction can be made in either of these items the balance of economic reasons which may at present incline toward the non-adoption of equipments may swing the other way. There is no question that much economy can be effected on both these points when a sprinkler system is fed by constant high pressure city supply needing neither roof tanks, force pumps or constant surveillance.

The advantage of a high pressure city water supply over the usual methods of secondary sprinkler supply in low pressure cities is also apparent. The high pressure derived from a satisfactory water works system is always available and ready for use. No pumps have to be started, nor fire departments called in to make connections with fire engines; all of the various uncertainties inherent to complicated mechanical apparatus, to negligence of watchmen, to accident or other reasons are to a great extent removed by this method of supply, not only to the great economic advantage of the owner, but to a decided advantage from the fire protection standpoint.

It is probable that in important mercantile sections where streets are narrow and the conflagration hazard severe, protection for exposed front windows will largely depend upon open sprinklers; all other forms of protective devices are open to the grave objections of owners from the point of view of disfiguration or inconvenience, and these objections are practically unanswerable. The average owner will rather face the risk of fire and pay for it in increased rates than disfigure his property by any window protection such as fire shutters now on the market or likely to be introduced, and to a minor extent wire glass is subject to the same objections.

While the protection afforded by open sprinklers may not be of so positive a nature as by good fire shutters, recent investigations are demonstrating their great value in the case of exposure fires, and the fact is undeniable that they are not subject to the same objections that apply to other forms of protection, their presence being comparatively inconspicuous. The extended use of these equipments along narrow streets will greatly reduce the exposure hazard and may be judiciously recommended or demanded by underwriters in cases where shutters or even wire glass are out of the question. A satisfactory high pressure city water system is essential on economic grounds to their adoption.

Effective interior standpipe service is another most important means of protection which can only be satisfactorily maintained in most high buildings by a constantly maintained high domestic pressure. This form of protection is particularly valuable in large warehouses and mercantile establishments where watchmen are kept and the service of a single well-directed hose stream applied in the early stages of a fire will result in extinguishment and the saving of heavy water losses. An interesting illustration of this fact recently occurred when a large warehouse in Hoboken was burned with a loss of some $200,000, solely through failure of the existing low pressure city supply to afford the needed protection. The entire cost of increasing water pressures in Hoboken would have been only a fraction of this sum.

A distribution system with mains of satisfactory size and arrangement and under pressures of from 80 to 100 pounds can furnish fairly effective hose streams, ample for most inside as well as much outside work, direct from hydrants without the intervention of a fire engine. These streams have the advantage of being always available without delay, and although indequate for the heaviest work in large fires they may be invaluable for preventing further spread. Such a service would probably have saved the bad secondary conflagration in Paterson, N. J., had one been available. It should be remembered that high pressures at hydrants enable a fire department to multiply the number of hose streams to an almost indefinite extent when the street mains are well proportioned. The cost of maintenance of a hose company is a totally different proposition from that of a steamer company.

In all of the smaller cities there is a serious lack of reserve force in fire-fighting facilities as compared with the larger cities, due to the inability of the smaller cities to concentrate heavy forces at any threatened point; the conflagration hazard is thus much more severe in these smaller communities than the physical conditions would otherwise warrant. This is well recognized in insurance schedules which allow credits to the assured in the larger cities on account of the advantages of concentration of steamer companies. The smaller communities cannot hope to wholly overcome this advantage possessed by the larger ones for obvious reasons, but the latent reserve force of a high pressure supply materially helps them to strengthen their fire-fighting force without incurring the heavy expense of extra steamer companies. Thus the higher pressures are even more necessary for the smaller cities than the larger ones in order to secure the same protection, but in view of the much greater values at stake in the larger cities their protection warrants the best service that engineering science can give, hence high pressure is equally necessary for both.

Another reason for the higher pressures in a city supply is the greater quantity that is deliverable from the mains under these conditions. The high pressure represents a latent power or reserve force inducing large capacity for delivery during unusual drafts. As an example, take New York City under its present low-pressure regime; it can readily be imagined that under the stress of an abnormal draft in the downtown districts the ultimate capacity of the mains might be reached and large districts left temporarily without supply. The present pressures probably approximate 30 to 40 pounds, but if they were in the vicinity of 90 or 100 pounds, fed by a reservoir at sufficient elevation, the force of gravity would have a much greater influence on the supply that might be drawn from the downtown mains, or, in other words, there would be a greater reserve force to overcome the friction loss incurred in the great length of pipe between the reservoir and the points of delivery. In many cases a high pressure system represents an actual saving in sizes of main feeders.

A series of exacting tests of the pumping capacity of fire engines in service in some 25 leading cities made during the past year by the Committee of Twenty of the National Board of Fire Underwriters, has demonstrated the fact that the average engine under the average management of fire departments has comparatively low efficiency. The tests were made under conditions highly favorable to the department, time, location and other matters being at their discretion, and the tests being only for very limited periods. The average efficiency of the engines, expressed in terms of their rated efficiency, was found to be only 80 per cent., some being not much more than 50 per cent. and some breaking down wholly. A failure to maintain adequate steam pressure, due to incompetent stoking, poor fuel or mechanical defects, was largely the reason for the poor showing frequently made by the companies. It is evident, however, that under actual working conditions at fires the efficiency of the fire engines will be much less than at these trial tests for obvious reasons. When, however, the supply from the hydrant is delivered into the fire engine at a high pressure the actual work demanded from the engine is much less than when the pressure is low. The work performed by the fire engine is proportional to the additional pressure which it imparts to the water received from the hydrant, therefore an engine fed by the higher pressure supplies will accomplish the same results with much less steam pressure than the same engine would with a low-pressure feed, hence the weakness inherent to poor steaming capacity is, to a large extent, eliminated. This is an important consideration.

Thus from a fire-protection standpoint there is every reason to urge the adoption of higher pressures in the domestic supply, but in certain cases economical reasons may cause communities to hesitate before incurring the extra expense. This, however, is a matter which principally rests with the community interested and not with the underwriters desiring to secure better protection. Experience shows, however, that the cases where the difficulties of obtaining higher and satisfactory pressures are greater than the advantages are very seldom encountered.

While the advantages of higher pressures are unquestionable and opinions on the subject can only differ as to degree, the objections are of a wholly different character. Practically no reason can be urged against the higher pressures "per se" from a fire-protection standpoint. No sane person, whether engineer or layman, would urge that a low pressure supply possessed any advantage over a high one with respect to fire fighting. The latter manifestly has inherent and latent qualities or forces not possessed by the other which the former has to acquire by special methods and devices, such as fire engines or fire pumps, in order to add the elements of force and quantity in which it is lacking. Moreover, even with the use of these devices the low pressure system, as shown above, does not possess the prompt and universal availability nor the capacity of the high pressure system; in short, the one can never compare with the other from the point of view of protection.

The line of objection against adopting the higher pressures is confined chiefly to reasons of expediency; in other words, the economic factor is introduced into the study. The danger of giving much weight to this factor is obvious, inasmuch as, strictly speaking, it does not fall within the province of the underwriter. To handle the economic factor, even in an approximately satisfactory way, would involve very exhaustive studies for each city. The investigations would necessarily partake more of the nature of surveys or careful reconnaissances in order to locate reservoirs, aqueducts, pumping plants, pipe lines and other structures to determine their feasibility, their economic location and actual cost, so that their advantages or disadvantages might be fully weighed against the estimated values of greater protection. These studies to be of any value must be of the nature of detailed estimates of the cost of various projects and would practically be a paralleling of investigations made by various city commissions and boards in connection with water supply and other matters. The impracticability of work of this character is obvious without further comment.

Investigations covering an exhaustive treatment of the economic factor may be safely left to the discretion of the cities interested and we may rest content with the assurance that no community will enter upon a new line of policy involving expenditures of large sums of money without carefully weighing in advance all reasons pro and con and clearly viewing the pecuniary advantages. Underwriters are thus relieved from any fear of inducing a community to embark on ventures that might subsequently prove unprofitable, but are not relieved from the possibility of advocating unreasonable or extravagant measures and thus weakening the cause of fire protection by creating a general distrust on the part of the public of the underwriters' recommendations. The economic factor must therefore be considered to some extent to ensure the reasonableness of any proposals advocated.

In studies for improvements in the water supply of a city it should be remembered that temporary measures are very seldom advisable or the part of truly economic policy. Practically all water works systems are, or should be, laid out with a view to the future even more than the present; they are permanent works in every sense, and well considered, broad views embracing every phase of utilization should be embodied in their design. They are essentially public utilities, even when of private ownership, being conceived and executed with special reference to the performance collectively of work that cannot advantageously or economically be performed individually. Their services are for divers uses which may be classified thus: Potable Uses, to sustain human and animal life; Sanitary Uses, for washing, cleaning, etc., both private and public; Protective Uses, for protection against fire; Productive Uses, for manufacturing, horticultural and mechanical purposes, etc. All of these are or should be, provided for in an efficient system and the design should aim to accomplish the maximum service for each class of usage consistently with requirements of the other classes and the means at hand.

It is obvious that a supply which did not fulfill the requirements for sanitary or productive uses, say, for instance, when the water supplied was impure or unwholesome, would for reasons of public policy be justly condemned, and we see on every hand cities abandoning unfit sources, building filters and clarification works and securing other needed improvements at great cost but with the full assurance that true economy lies in that direction, the economy being in human life and health or greater productiveness. The same argument applies to the protective uses; a system that does not apply means for good protection is not fulfilling all of its functions as a public utility and improvements are decidedly in order.

The elementary fact that fixed charges represent capital outlay is too often overlooked especially when the "other fellow is paying the fixed charges" and the fixed charges for poor protection are paid by the public in so indirect a manner that the actual economy of securing better protection is lost sight of.

The owner of a hazardous property in a congested district who installs a good system of sprinkler protection is performing a public service, he not only protects himself, thereby securing decreased insurance rates, but he helps his neighbor by lessening his exposure hazard. His neighbor, on the other hand, who does not equip his premises, receives an unearned benefit, but in return confers a disfavor by the bad exposure of which his premises are the origin. The man who has adopted the sprinkler protection possibly may have to meet the expense of buying, maintaining and operating fire pumps and other apparatus which might not have been necessary if the city water supply had been adequate in pressure. He has, however, no advantage in his insurance rates for this additional expense, which should properly be borne by the community and in which his neighbor would share. Thus an inadequate water supply tends to check personal initiative in effecting improvements by the imposition of unjust burdens on the improvements themselves.

Good protection requires high pressure in supply. If the high pressure is not furnished by the water works system, it must be produced by individual fire engines or fire pumps in buildings before the water can be effectively applied for extinguishing purposes, and in the latter case much heavier collective expenditures are generally incurred by a community than would be the case if the city mains furnished adequate pressures. The actual result of the operation of most low pressure systems is that needful protection is not generally secured.

Future policy of underwriters and municipalities is unmistakably tending towards the reduction of fire hazard by the securing of improvements in construction and protection of buildings. The large fire losses that exist to-day are being recognized as an intolerable drain on the resources of the public that must be reduced by all reasonable means. State and municipal legislation are combining to enforce better conditions, and it is to be hoped and expected that in the near future very decided legislative measures will be enacted in all large cities to prohibit the erection or to enforce the complete protection of premises which constitute a "public nuisance" by endangering a whole community. In plain language this will mean the wide enforcement of such protection as automatic sprinklers, outside sprinklers, interior and exterior standpipes, etc., all of which equipment calls for high pressure domestic supplies. The securing of such pressures to-day will pave the way for the introduction of these improvements in the future.

Thus the policy of advocating the higher pressures is distinctly framed on lines of broad public policy, and a close study of each individual city will generally reveal the truth of this statement, even if apparently the cost of the improvement to-day seems to be somewhat unwarranted by the immediate advantages in protection to be secured thereby.

In works of a permanent nature, like a city water works system, which are constantly undergoing enlargement and extensions, a reorganization often becomes the more difficult and expensive the longer it is deferred, hence it may be accepted as axiomatic that changes will seldom be more readily performed in the future than they are to-day; that the more deep-seated the disease becomes the more painful will be the remedy. Many millions might have been saved by a full recognition of this fact and we need go no further for a shining example than New York with its partially completed Jerome Park reservoir, a work that has become obsolete even before its construction has been completed at a cost of from $7,000,000 to $10,000,000.

The reorganization of a large city water supply to secure higher pressure is wholly one of expediency, to be settled by the city itself, but underwriters should not hesitate to point out unsatisfactory features and to place themselves on record as disapproving unsatisfactory conditions, and where possible indicating acceptable measures. It is fully appreciated that in carrying out these ideas large and complex problems may present themselves and we may be faced with the alternative of being inconsistent or making recommendations involving widespread reconstruction in existing works. It is not, however, to be expected that any large community will hasten to plunge into wholesale reconstruction; it is fully recognized that slow progress only can be expected in important changes in policy, but it is believed that in practice underwriters must often occupy a pioneer position in indicating the need for changes or modifications, some of an imposing character. Although many of these far-reaching recommendations may for the present be of little avail, yet the deliberate opinion of such an organization as the National Board of Fire Underwriters as expressed in its reports is undoubtedly of weight and in certain crises its influence may be sufficient to swing the balance of future policy in the desired direction.

As an example may be quoted the situation in Massachusetts in 1895, when the Metropolitan Water Board was organized and the new water works system for the Metropolitan District was designed. The design of the entire system was based on a development of the old Boston water works supply system which had been originally laid out by a previous generation on the then common basis of low pressure. Before any construction work was started in 1895 a new design for a supply by gravity high pressures was proposed by Mr. John R. Freeman. This proposal involved the then somewhat novel idea of a great steel pipe connecting the "Wachusett Reservoir" directly with an elevated reservoir at Belmont, near Boston. The proposition was ultimately rejected, but there is strong reason to believe that little additional impetus might at one period have swung the balance of opinion in its favor; possibly a strong demand from the united underwriting interests might have been sufficient. Boston is now committed for a generation to a low pressure supply with alternative of pumping if higher pressures are desired.

The most conspicuous example of a great city turning over from low to high pressure is furnished by New York. The present Croton system developed from designs originated two generations ago is designed for a low pressure delivery and all of its reservoirs, aqueducts and terminal facilities are constructed on these lines. Owing, however, to the inadequacy of the present supply a very comprehensive extension of the system has been undertaken which will ultimately lead to a general raising of domestic pressures throughout Manhattan and Brooklyn to approximately 80 to 100 pounds. How absurd it might have appeared if underwriters in 1902 had taken upon themselves to advocate a general increase in pressures in New York to upwards of 80 pounds by a wholesale reconstruction of its supply system. Yet the city has for reasons of its own (but particularly for fire protection purposes) undertaken to furnish the increased pressures in spite of the fact that equal quantities at lower pressures might be obtained at much less cost.

The Exports of the United States for the year ending June 30, 1905, were the largest on record. The total exports of merchandise were $1,518,561,720, the value of the products of domestic manufacture being $543,620,297. Iron and steel products were the most important single item, and amount to $134,727,921. Copper products valued at $86,225,291 came second, and refined mineral oil valued at $71,888,317 came third. Cotton goods, worth $49,666,080 came fourth. The enormous growth in the export of domestic manufactures is shown by the total figures for recent years: 1890, $151,102,376; 1900, $433,851,756; 1901, $410,932,524; 1902, $403,641,401; 1903, $407,526,159; 1904, $452,415,921. The significance of these figures is greatly increased when they are examined in the light of the frequent criticism of our consular representatives regarding inadequate packing, shipping and selling methods of the average American manufacturer in conducting his export business.

Power Development by the Lewiston-Clarkston Co.

The gradual growth and development of the old Oregon Territory, comprising the present States of Oregon, Washington, Idaho, Western Wyoming and Western Montana, went on quietly but forcibly under the efforts of those sturdy pioneers, Astor, Whitman, Dr. McLaughlin, and others, and increased by the gold seekers of California drifting northwards. The Upper Snake and Columbia Rivers proved a fertile field, and in the late fifties the old trails of the explorers were again traversed by pack trains and miners. In 1861, a city of tents and shacks arose at the confluence of the Snake and Clearwater Rivers, out of which has grown the present towns of Lewiston and Clarkston.

The Clarkston Auxiliary Station of Concrete and Steel.

The Clearwater Valley occupies a central and commanding location in the Inland Empire, which is that section of the country lying between the Bittir Root Mountains and the Cascade Ranges. This country has a number of large water powers. To the north the large development of the West Kootenai and Upper Columbia Rivers and the Falls of the Spokane River. To the south the development of the Shoshone Falls of the Snake and its upper tributary streams. The high price of coal, wood and oil fuel throughout that section has, therefore, brought the inevitable demand for commercial development of its water powers. The stations and transmission system of the Lewiston-Clarkston Co. in this district were described at a recent meeting of the Pacific Coast Electric Transmission Association by Mr. Allen E. Ransom, the company's electrical engineer, from whose paper the following notes have been taken:

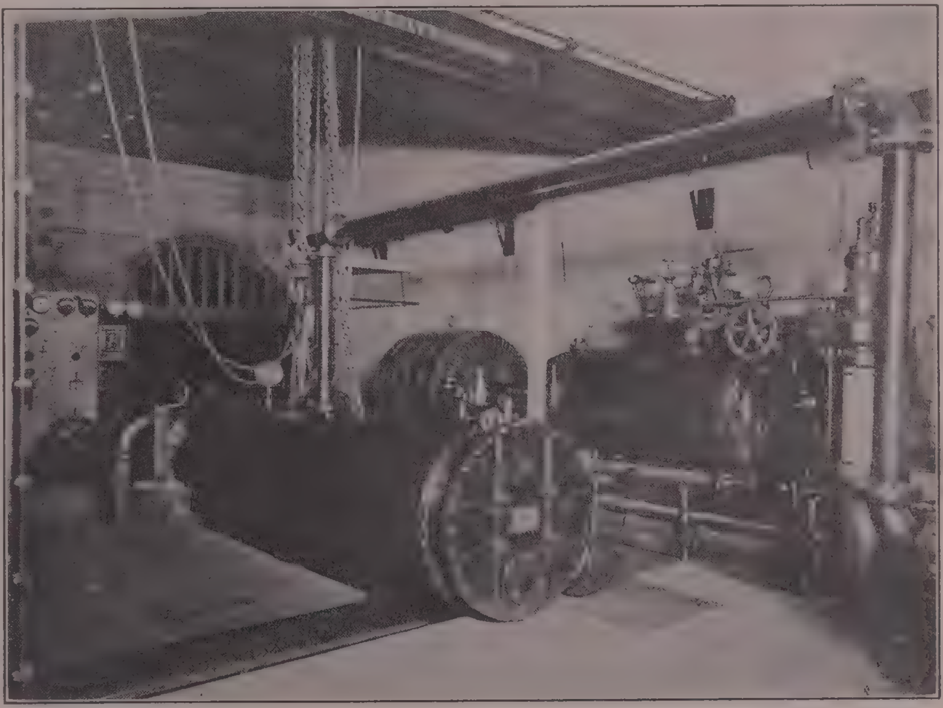
The system at the present period consists of two power stations with a combined steam and hydraulic capacity of 1,500 h.-p. and 50 miles of transmission lines, with secondary distributing systems and substations in five towns and extensions under construction to several other towns in the Palouse country.

Power Station No. 1 is situated on Asotin Creek 7 miles from Lewiston-Clarkston and 1½ miles above the town of Asotin. The irrigation flume of the company furnishes the power used at this station and winds around the valley for 7 miles. This flume was designed for a capacity of 125 cu. ft. per second and is used for power and irrigation. The plans of the company contemplate building a flume at some 300 ft. greater elevation and constructed of concrete. By thus increasing the head and capacity, the development of a new station of 2,500 h.-p. capacity becomes possible.

In the present hydraulic station much satisfaction has resulted from the use of the Tirrill induction regulator and the saving on lamp renewals, it is estimated, will pay for the device in a short time.

The Lewiston substation contains three 200-h.-p. capacity transformers and is connected with the Clarkston auxiliary steam station by a three-wire 0000 circuit. By means of the Tirrill regulator in each station it is possible to keep the regulation at a very close point.

The Clarkston steam auxiliary station, designed by the consulting engineer, Mr. William Wheeler, of Boston, is built in accordance with the most recent engineering experience. The equipment therein consists of a 500-kw. (tested to 1,200 kw.) Westinghouse-Parsons steam turbine equipment operating at 2,300 volts, 60-cycle, three-phase. The station is built of concrete and steel and is divided into two large rooms, the boiler room containing the boilers, feed pumps and induced draft apparatus, and the other room containing the engines, generators and high tension transformers.


Turbine Plant in the Clarkston Station.

The Palouse country transmission lines enter this station and by a bank of three 200-kw raising transformers the towns of Genesse and Moscow, 18 and 26 miles, respectively, distant from Clarkston, are supplied with power at 22,500 volts. The transformers are so designed that they may be connected up for 22,500 or 45,000 volts delta. The transmission line is designed for operating voltages up to 60,000 volts.

The pins used are a composite type, the arm pin being designed by Mr. D. L. Huntington, of the Washington Water Power Co., of Spokane. The top pin was designed by Mr. Ransom after a careful examination of all top pins used on various lines throughout the country, and so far has proved very satisfactory. A number of bending tests of the pins adopted was made, with the results that the top pin bent under a weight of 738 lb. and the arm pin under a weight of 984 lb., which indicate ample strength for all purposes of line construction. The top pin as constructed weighs 8 lb. and costs 46 cents; it is a welded pin of iron and steel. The arm pin weighs 8½ lb., has a base of cast iron around the steel, and costs 36 cents. Over 5,000 of these pins have been put in use on the transmission line in the last ten months and none have been replaced yet. The spacing of 48 in. on the transmission was adopted after considering the various lines in operation, and has been adopted throughout the transmission.

The telephone line, situated 5 ft. below the transmission, is transposed every five poles, and there has been no trouble from induction or other causes. Each telephone is protected by a high tension fuse outside and a small lightning arrester at the instrument. At the present time, Mr. Ransom is experimenting to find the best gap to use on the lightning arrester, as he has experienced some difficulty in connection with the ground wire on some of the arresters. Any ground on the system makes it almost impossible to talk over the line at all. With the line perfectly clear, there is no trouble whatever with the 1,600-ohm telephone of the Stromberg-Carlson type.

The main transmission line as at present constructed is composed of three No. 4 B. & S. gauge and two No. 14 B. & S. gauge telephone wire. The transmission wires are supported by 12-lb. double petticoat insulators of the Thomas No. 50 type, and the telephone wires on cross arms and glass insulators.

In the first three miles out of Clarkston, the line crosses the Snake River over a 2,000-ft. span, and ascends the Uniontown Hills at an elevation of 2,000 ft. in this distance. The construction of the span of the Snake River brought in several elements as to wind pressure and variations of temperature. The span consists of five No. 4 B. & S. hard drawn copper wire of a breaking tension of 1,967 lb. These cables are strung with a tension of 700 lb. and one tower being much higher than the other necessitated a special flexible connection to prevent the breaking of the wires due to the abrupt angle at the higher elevation of the north tower. This flexible connection has proved satisfactory, and for the use of it the company was indebted to a suggestion made by Mr. K. G. Dunn, of San Francisco. As neither ice nor sleet is prevalent in this section, this element has not entered into the construction of the span.

The span as at present constructed is successful. There have been several wind storms, varying from 45 to 60 miles an hour and temperature variations of from — 10° to + 90° F. during the four months that these wires have been strung. The current has been carried continuously for some 60 days and no trouble has been experienced. The same has been true of the entire transmission line, and, except for a few insulators, it has not been necessary to make any repairs on the line. The continuous operation of 24 hours a day has not been interrupted. Several severe electrical storms have been experienced, but the arrester equipment at the stations have handled the lightning very successfully.

In connection with this system the municipal pumping has become quite a feature. The municipal pumping station at Lewiston is the largest electric driven plant in the Northwest. The installation consists of a 200-h.-p., 2,000-volt, three-phase, Type C induction motor, connected by a gear to a Dean triplex pump of a capacity of 114,000 gal. an hour, pumping to an elevation of 345 ft. The city has two reservoirs, one at an elevation of 220 ft. and the other at an elevation of 345 ft. This pump has been in operation for nearly two years and has proved very successful. The city of Genesee has also adopted a pumping station on a smaller scale, lifting the water 150 ft. by means of a Gould triplex pump belt connected to a 20-h.-p. induction motor, its capacity being about 20,000 gal. per hour. Moscow will soon be similarly served.

The wood-finish mills of Lewiston and Clarkston, as well as the machine shops, are driven entirely by induction motors of from 5 to 50-h.-p. capacity and have proved to be very satisfactory as a source of power.

The construction of an electric railway is now assured, which will offer a market for power for this purpose. In view of the rapid growth of power business in this section with the development of the gold and copper mines of Snake River plans and investigations are now being made for the development of an additional 8,000 h.-p. on the Grande Ronde River, 36 miles distant. The development of a transmission business in a rapidly growing country produces the inevitable demand for the development of all water powers available. And in this section the prospects for a large and varied application of electric power makes it one of great interest.

Causes of Body Crazing in Sewer Pipe.

Abstract of a paper read before the American Ceramic Association by Walter A. Hull, Drummond, Pa.

When the writer became connected with the factory where the observations to be presented in this discussion were made, he found a dearth of kiln burners. The clay used is a coal-measure fire clay, containing considerable carbonaceous matter. That oxidation was a prime requisite to successful burning was a foregone conclusion. In conducting the burning with the help immediately available, the writer made a virtue of necessity and studied the problems first hand, at short range. Among those which presented themselves, the most persistent and what promised for a time to be the most baffling was "crazing"; not glaze crazing, taking place during or after the cooling of a kiln, but body-crazing, occurring during the burning, as an examination of the crazed pipe plainly indicates. The glaze always extends down into the cracks and in many cases covers them completely, leaving only a slight undulation on the surface of the pipe to betray their presence.

All the contributary causes were considered and all the possible preventive measures were taken. The pipe were set dry, and the kilns carried along most cautiously during the water smoking and well into the dehydration period. At the same time great pains were taken to prevent fluctuations of temperature; dampers were lowered during the cleaning of the fires, and light firing was done at frequent intervals. It also became the practice in cleaning the fires to clean a hole and skip a hole, clinkering the remaining alternate furnaces in turn. The day men would clean every other one and the night men do the balance, thus extending the process over a considerable period of time By means of all these precautions we did away with the trouble for a time, but it came back. Burners who by this time were considered trustworthy were accused of carelessness, and yet none could be detected.

The trouble was finally located in the oxidation period. We had taken it for granted that the greatest danger was passed by the time a kiln was red to the bottom, and yet had exercised what seemed to be reasonable care up to the finish. As was stated at the outset, the clay used requires an extended period of vigorous oxidation. In order to provide for this our practice was to commence to increase the air excess soon after the kiln was cherry red to the bottom, at the same time arresting the progress of the rise of temperature and holding it practically constant. This was done by leaving a considerable open space over the fuel bed to permit the influx of air. Inclined grates without doors are used, and the method described was a simple and effective means of accomplishing the necessary oxidation. It was the intention to maintain a constant temperature with a good air excess for twenty-four hours or more before proceeding to finish the burn.

It was observed, however, that the crazing was worst in those burns in which our oxidation treatment was most vigorous. The reason is apparent when we consider the causes of crazing, which will be discussed further along, for while no perceptible cooling of kilns took place, the tendency of the method was to produce comparatively short and rapid fluctuations of temperature. The burners had learned at the beginning that with a good draught and a moderate bed of fuel, the temperature of the kiln would rise rapidly at this stage unless the fires were left very much open. Consequently a reasonably large opening would be left over each fire when coaling. This would give an air excess even immediately after firing. The trouble was that as the fires burned down the openings would grow larger instead of smaller, so that when the furnace was making the most heat and the coal was distilling off volatile fuel most rapidly, the air influx would be least; on the other hand, when the bed of fuel was reduced to a mass of incandescent coke, which would burn perfectly without any secondary air inlet, the mouth of the furnace would be wide open and doing business on a large scale.

The natural remedy was to use a lower damper during this stage of the burning than when heating up, and to try to provide for an air excess by keeping a thin bed of fuel on the grates. It is not easy, however, to secure a uniformly thin bed of fuel on inclined bars and at the same time to keep the furnace mouth closed with coal. Another difficulty is that with a coal which cokes and hangs, constant vigilance is required to keep big holes from burning through and making the very trouble which we are striving to overcome. At any rate we succeeded fairly well as to crazing, but the oxidation secured was too feeble and it was found necessary to admit more air. It had not been found satisfactory to regulate this air flux at the furnace mouth by means of the fuel itself, so more uniform openings were provided.

The practice now in operation is as follows: After each fire has recovered from its first cleaning a 5-in. sewer pipe is inserted through the fuel bed near the bottom of the bars. The burner pays no further attention to this pipe until he is ready to allow the kiln to proceed towards vitrification. All the pipes are then withdrawn. The result is simply to increase the air excess during the period when it is most essential. As the opening is just as large immediately before coaling as at any other time, the air excess of the kiln is somewhat extravagant after each fresh coaling has ceased to throw off its volatile combustibles, but as the increase is gradual no harm is done and it is not found necessary to damper these secondary air holes. Oxidation is thus accomplished without producing fire cracks.

In the meantime, however, it had been observed that there were two distinct kinds of crazing, apparently arising at different stages of the burning and due to separate causes. The irregular zigzag cracks, usually circumferential, which are sometimes observed on pipes of any size when exposed to the direct play of the gases, we will designate as "fire cracks," while those which we occasionally see extending in a net work over the entire surface of big pipe that have been heated too rapidly in the first stages of the burning, and which give them the appearance of alligator skin, we will call for convenience "water cracks." The cause already stated suggests the obvious remedy for this kind of crazing.

For the better understanding of the behavior of sewer pipe in burning, it is necessary to study its structure briefly, and this leads us to a consideration of the manner in which the clay is forced into the form of pipe in the press. Here we have a hollow cylinder with a diameter of, say, 24 in. At the bottom, the walls of this cylinder are suddenly constricted so that they form the outer portion of a comparatively flat basin. In the center of the above cylinder is a rod, held in place by a spider. At a level corresponding closely to that at which the outer cylinder "dishes in," the center rod "dishes out"; that is, it is suddenly enlarged by the "core die," or "bell." Between the outer basin and the inner bell remains an annular space as wide as the thickness of the green pipe to be made in this particular die. We have in the above hollow cylinder, a solid, compact mass of plastic clay, under heavy pressure, traveling downward. At the bottom the whole mass is forced to travel toward the narrow, circular slot, mentioned above.

Considering the outside only of this clay column its surface may be regarded as a compressed sheet, polished by contact with the surrounding wall. When this sheet reaches the constricted portion of the die it is forced to travel over a rapidly narrowing surface, causing it to double and thicken to a compressed layer, which is somewhat denser than the clay body within it. This outer layer is not distinct and separate from the body of the pipe, but the laminations are strong enough to cause an easy separation, along regular lines of cleavage. The body is laminated throughout, but it is chiefly the superficial layer which we have to consider in the study of crazing. To simplify this discussion the pipe will be spoken of as if it consisted of two or more or less distinct portions, the "outer layer" and the "body of the pipe." We may also consider that the cleavage planes caused by lamination form barriers between the body and the "outer layer" of the pipe, blockading the line of travel from one to the other of either heat or gases. This effect is more pronounced than might be supposed. It is easy to believe that cleavage, by breaking the continuity of the substance, will cause heat to pass through it less readily. That the laminated structure also retards the passage of gas can be seen by examining the longitudinal fracture of a burned pipe which has a black center. From the spigot end oxidation has penetrated much deeper than from the sides, although the end has been protected by resting on the pipe beneath it while the sides have been fully exposed. This same tendency is more strikingly demonstrated by placing a broken piece in the kiln with the edges exposed. Unless the piece be very large it will be oxidized throughout though the pipes of the same thickness are black centered.

The laminae of the pipe being thus separated by barriers, the pipe itself is the more easily affected by the causes ordinarily assigned to the cracking of clay bodies, viz.: 1, The more rapid expansion of one portion than of another. 2, The more rapid contraction of one portion than of another. 3, The pressure of confined gases generated within the clay body.

In considering the first two causes, it may be assumed that the changes in size which occur in the body of the pipe take place gradually, and are not affected by slight fluctuations of the kiln temperature. Therefore, for purposes of discussion, the outer layer of the pipe may be said to expand or contract independently of the relatively inert body within it, and this expansion or contraction may produce pressure or stress which is greater than the strength of the "outer layer." The natural consequence of such action would be the disruption of the outer layer.

Taking the first possible cause separately it may be said that it seems to be the least probable of the three. The general tendency of the entire process of drying and burning is towards shrinkage, and as the progress of the inner body is always a stage behind that of the outer portion, the latter is kept in a state of tension rather than of compression, and a sudden fluctuation which would relieve the compression would be less likely to do damage than one which would increase it. While a sudden flash of heat might expand the outer layer of the pipe to such an extent that it would crack after the fashion of the crazing of a glaze, yet the crushing strength of the material is undoubtedly much greater than its tensile strength, so that we would expect tension rather than compression to produce the superficial cracking.

The second cause is a more probable one. Assume that the outer layer of a pipe is already in a state of tension at, say, a cherry red heat. Suppose that one fire or more burns low for a short time, and that a strong draught draws airs in over the bed of coals. A comparatively cold current may play against one side of the pipe in question and chill it superficially. The added tension would crack the outer portion of the body if the contraction were too great and too sudden. Repeated observations has led to the belief that this action is responsible for most of the long zigzag "fire cracks" with which all sewer pipe makers are more or less familiar. "Fire cracks" of this nature are seldom seen on the bottom pipe of a kiln where fluctuations are least sudden. They are common on pipe of any size set near the tops of the bags. Big pipe set high in the kiln and not protected from the direct play of the fire gases are sometimes affected. It is here that fluctuations of temperature are most pronounced. Nearer the bottom of the kiln the influence of the hot ware above, together with the more thorough mixing of the fire gases, tends to equalize the conditions. It has been observed repeatedly that the fire cracks are usually found where the currents of gas travel most freely. If the pipes lean a little in some portion of a kiln, leaving an invitingly wide open space for the draught to follow, comparatively small pipe crazed on one side may be found next the open space, whereas larger pipe in the next ring will not be affected. It seems to be a case of superficial shrinkage, due to the cooling of the outer portion of the pipe. The inner protected portion is slow to feel the effect of the cold current, and does not contract with the outer layer.

The third cause—pressure of confined gases generated within the clay body—is responsible for the checker-work cracks previously designated as "water" cracks. This sort of crazing is the result of the same action which causes blowing. All sewer pipe burners know that if they were to heat a kiln of big pipe rapidly from the beginning, the result would be precisely the same as if small gunpowder mines had been placed within the body of the pipe. Great slabs would be broken loose on the outside of the pipe, and in some cases these slabs would be found at the bottom of the kiln, having been actually blown off by the force of an explosion. For this phenomenon there is but one probable explanation—the formation of gas within the pipe more rapidly than it can make its way out through the moderately porous body. The offending gas is unquestionably steam. The shales and fire clays used for sewer pipe do not contain anything except water which is either volatile or chemically destructive at low temperatures. The comparatively low percentage of bituminous matter could not be considered dangerous, even if it were much more easily volatile than it is. As for the carbonates, sulphates and other destructible compounds, they are known to separate reluctantly and only at temperatures at which the clay body has attained a high degree of both porosity and strength. It is safe to assume, also, that the chemical water comes off gradually and, by reason of the then porous condition of the body, makes its way to the surface easily and without any disturbance.

The responsibility then rests jointly with the mechanical and hygroscopic water. The guilt may belong to the mechanical water exclusively, or altogether to the hygroscopic water, but it is also possible for the hygroscopic water to be the red-handed individual, while the mechanical water is equally culpable as an accessory before the fact. As an illustration of the first case, the writer cites an instance in which a 15-in. pipe was set green in a kiln of dry pipe, which was to be heated up comparatively rapidly. This green pipe was marked for identification, but this precaution proved to be unnecessary, for when the kiln was opened our "test piece" looked like a very ancient chestnut stump from which most of the decayed sap-wood had fallen off in patches, exposing the relatively sound heart. Our marks were found on a detached slab, which lay on the floor of the kiln. It would not be fair to charge this ruin to the account of hygroscopic water. The presumption is that our pet was a hopeless wreck long before the dawn of the hygroscopic morning.

On the other hand, pipe have been left in the dryer for days after they would ordinarily be pronounced dry; the kiln in which these alleged dry pipe were set was then kept on low fire for four days or longer, the temperature not greatly exceeding 100° Fahr., and then carried along at a moderate rate. Thirty-inch pipe treated in this way have been known to blow. The writer is not inclined to hold the mechanical water accountable, although he has no direct proof that the last fraction of a percentage of mechanical water had passed off before the blowing occurred. The lack of exact records of these burns is to be regretted, but this is to be explained by the fact that since we have kept fairly accurate temperature records, we have had no cases of blowing to record.

The third case—that of double responsibility—is just as probable as the other two. Suppose a few big pipe to be set greener than the balance of the kiln, and assume that the burner takes this into consideration and handles the kiln with a little extra caution. For three days or longer the temperature of the kiln remains below the boiling point. The dry pipe have nothing to do but to warm up at about the same rate as the kiln atmosphere. In the meantime the green pipe are drying, and because of the evaporation going on within them are keeping cool. As the kiln temperature rises that of the dry pipe keeps pace with it while that of the drying pipe lags farther and farther behind. When it is finally dry mechanically and just ready for congratulation on that score, it suddenly discovers that its neighbors are much hotter than itself and are now serenely passing through the second stage of the drying. At the same time our tardy pipe begins to realize that the kiln atmosphere is hotter than it has seemed till now. A short time ago the refreshing influence of evaporation was sufficient to keep it fairly comfortable. It now becomes alarmed and tries to hurry, but it cannot gain appreciably. Its fellows have taken advantage of their handicap. The unfortunate individual has been sweating comfortably all the while, but now it begins to steam—moderately at first and then in a frenzied sort of way, which plays havoc with its outer garments. Bye and bye, after the race is over, the verdict will be "green pipe—blowed, chuck." Or if it be a less desperate case the drawing gang will observe a crazed pipe here and there, and decide that the country is going to the dogs. But we must not anticipate. Though the poor pipe may be shamefully denuded, yet it must stay in that kiln until the finish. After a time it reaches the dehydration stage and forges along lamely, while its companions of a few days since are passing out of that stage into the next, where they will tarry a while for a period of much needed oxidation. This is, indeed, an opportunity for the laggard; it will not waste time by pausing for oxidation, but will rush along and gather up what it can as it goes. In fact, no alternative remains. The burner is busy outside and a vitrifying atmosphere is coming through the kiln. The pores are closing in the outer layer and oxidation is no longer possible. There is but one thing to do—the pipe rushes along, takes its glaze and finishes with a bright face and a dark heart. Some days later one of the boys breaks this pipe open and remarks, "bluing spoils them; blowed pipe most always have a black center." The boy is correct in his observation, but not in his conclusion. Reduction and blowing may follow indirectly from the same original condition, but one does not cause the other unless our reasoning is grossly erroneous.

It is pretty generally conceded that blowing is directly attributable to steam pressure within the body of the pipe. The explanation is a simple one and the effected pipe look the part. With crazing, however, the case is not so obvious. We can readily conceive of steam forming so rapidly that it cannot escape through the pores and must destroy the pipe by its expansive force; from this it is but a single step of the imagination to picture this same steam forming slowly in the pipe body, and gradually making its way from one porous layer to another in its quiet and harmless escape to the surface. Now assume that we have a condition between the two. Steam is passing out through the pores, but not as rapidly as it is being formed, and the pressure is increasing. Something must give way. The weakest portion is the outermost lamina, and this, because of its density, is also the most stubborn barrier. Here the expanding steam exerts its accumulated pressure and the crust yields. Instead of a concentrated explosion we have a miniature earthquake. Why the cracks should describe their characteristic alligator skin figures is not easy to account for. In fact, this explanation has been accepted by the writer with hesitation after making observations that ought to be conclusive. To illustrate—the kiln is heated too fast in the first few days of the burn and then allowed to lag. The top pipe are blown and the bottom pipe are perfect, while between the two is a regular gradation of blowing, blowing and crazing combined, crazing alone, less crazing and no crazing. Again, the phenomenon may be reversed. In this case the kiln has been allowed to idle along for two or three days, taking just enough heat to carry the top pipe well along through the drying, while the bottom pipe lag behind in a cooler and moister atmosphere. The burner raises his fires a little, the bottom pipe are not ready for the change and suffer in consequence. Here the gradation is reversed; perfect pipe on top, then crazed pipe with blown pipe below, if the case be a violent one. Such occurrences seem to show an established relation between blowing and the defects which we have termed "water-cracks."

The conditions which result in crazing are so various and elusive that the foregoing discussions have been resorted to in order to demonstrate that there are two distinct kinds of crazing:

1. The fire crack type, which is caused by sudden fluctuations in temperature. No limits have been assigned to the time or period at which these fluctuations are destructive, but it has been shown that their action is effective in the oxidation period.

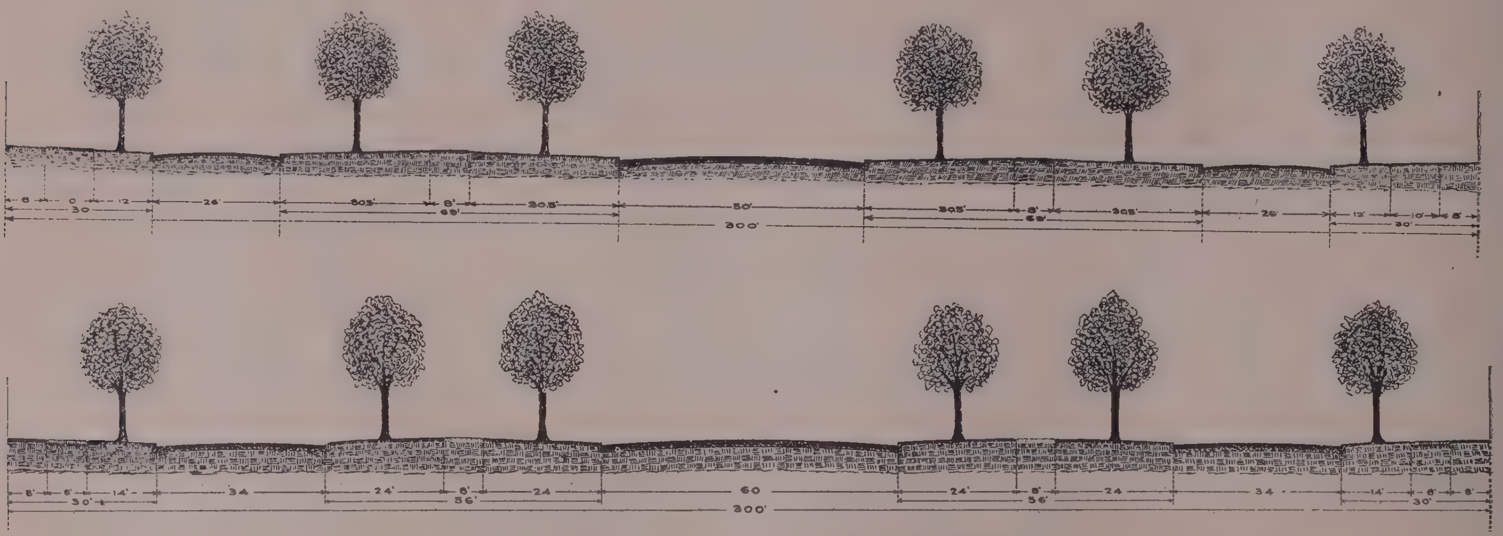
2. The alligator variety resulting directly from the pressure of confined steam generated too rapidly, because of a poorly arranged programme in the early stages of the burning.

It may be said in conclusion that vitrification plays an active part in bringing these defects into prominence. Crazing would hardly be detected on an under-burned pipe, but the tendency of vitrification is toward shrinkage, and the final appearance of the crazed pipe is like that of the little flannels on the child whose mother didn't use proper soap—they gap and curl at the seams.

Recent Municipal Work in Philadelphia.

The development of American cities often causes the early plans for engineering work to be outgrown, and the fitting of these antiquated systems to the requirements of the present time is one of the most troublesome and thankless tasks of the municipal engineer. This is particularly the case in those older cities where records are inadequate, and it is for this reason that foresight is imperatively needed in all plans for the future, in order that succeeding generations may not be needlessly burdened by the work of today. These reflections are suggested by the interesting report for 1904 of Mr. Geo. S. Webster, chief engineer of the Bureau of Surveys of Philadelphia.

Improved Sanitation.—The rapid increase in urban population in each decade, Mr. Webster says, serves to fix the attention of municipal authorities upon the possible needs of the community at the end of three decades, with a view to making all present projects conform to these requirements, and as far as may be to the requirements of a more advanced date. While the present need of Philadelphia is for the extension of systems of drainage to permit of the development of land, so as to provide adequate accommodation for its inhabitants, as the population becomes more dense and residences encroach upon the banks of the streams, demands will be made for the rectification and beautifying of the banks of the rivers, on a scale commensurate with the importance of the city, and in conformity with the modern practice, with a subsequent diversion of all pollution from wastes into other than the river channels and the final disposal of these wastes in a more sanitary and satisfactory manner.



Typical Cross-Sections of the Boulevard Extension in Philadelphia.

At present the volume of flow in the Delaware River is so great as to give rise to no complaint concerning the discharge of city sewers into it. For some years, however, complaints of the Schuylkill River have arisen, and a tentative plan for intercepting the sewers emptying into that river has been provided. Methods of construction have changed and improved with the advance of years. At the present time there is a tendency to utilize concrete or reinforced concrete in place of the brick and stone construction for sewers. The city has constructed a number of the former, where conditions were most favorable, and, Mr. Webster says, the indications are that in a short time this type will come into more general use, with a possible cheapening of the cost of construction.

The occasional breaking of old sewers, built many years ago before hydraulic cement was in use, is due to the sewers wearing out and requiring renewal, but should not be used as an argument for decrying the whole sewer system, 80 per cent. of which has been built under modern conditions. In past years there has been a tendency to permit the drainage of large areas to run into small streams, until such times as the streams become too much polluted to be sanitary when legislation has been passed to build the main sewers to contain these streams. Of late years, however, the policy has been to begin the construction of a drainage system at its outlet and extend towards its source, which is in many ways the most satisfactory. The demand for the preservation of inland streams, especially where projects for park reservation enter into the question, will result in the establishment of many systems whereby the sewage is intercepted, and storm water only be permitted to enter the natural channels.

City Plan Revision.—A large part of the general plan of Philadelphia, covering sections not yet built up, was confirmed more than forty years ago, and the streets were projected of general uniform widths of fifty or sixty feet, upon what has come to be known as the "gridiron" system. This system has been the subject of much public criticism. The commercial and industrial growth, the construction and expansion of railroad lines, the needs of a rapidly increasing population and the conditions and requirements of the business and social interests have revealed many serious defects in the old system which should be corrected as far as possible in order to provide for future municipal development along progressive lines. Large areas over which the "gridiron" plan was spread years ago are still entirely unimproved and the Bureau of Surveys is now, and has been for several years, devoting much time and thought to the revision of the city plans wherever such work can be done advantageously and economically, with a view of creating a system of streets which will conform to local and general conditions, establish direct and convenient means of communication, provide for future expansion of the city and encourage its growth along lines which will combine possibilities for ornate and attractive development with the greatest possible degree of usefulness. In order that the future needs of the city may be properly provided for, the general plans for street extensions are carried far in advance of present demands and the details are filled in as required by the actual growth of improvements.

Parks and Parkways.—There has been a constant growth of interest in the movement to increase the park areas of Philadelphia, and to establish a system of connecting parkways or boulevards; public interest in these matters has been greatly stimulated through the activity of the "organizations allied for the acquisition of a comprehensive park system" in holding public meetings and distributing publications setting forth the objects of the organization, the work it hopes to accomplish, and the advantages to be derived therefrom by the entire community. Nearly every large city in the United States is actively engaged in the work of park and parkway extension; many of them have employed experts and have had prepared very extensive and elaborate plans for such improvements upon which they are expending, or preparing to expend, large sums.

Philadelphia possesses splendid opportunities in the topography and attractive natural features within and adjacent to the city limits for the creation, at moderate cost, Mr. Webster says, of an admirable park and parkway system. Plans are gradually being evolved for the acquisition and development of a comprehensive system which will make the city more interesting and attractive and provide adequate opportunities for healthful outdoor exercise and recreation for the present and future generations. Certain portions of the system have already been officially approved, the plans completed and the actual work of improvement commenced.

The plans for the continuation of the Boulevard, from Vankirk street to Rhawn street, a distance of about three miles, with revision of streets covering about 1,400 acres, were confirmed July 11, 1904. Preliminary plans for the section from Rhawn street to Torresdale, about three and one-half miles, have been prepared. Construction work begun in 1903 upon the section from Broad street to Second street, has been continued. The approved cross-section is as follows: Sidewalk widths of 30 ft. on each side, including walks and planting spaces; service drives each 34 ft. wide between the sidewalks and main planting spaces, the latter being each 56 ft. in width separated by the main driveway which is 60 ft. wide and occupies the center of the Boulevard. The walks are granolithic; the drives are being constructed of macadam with brick gutters and steel bound concrete curb; the planting spaces are being ornamented with trees and shrubbery; drainage is being provided for by the construction of sewers and inlets.

City Datum.—An investigation has been made to determine the origin of "City Datum," the base to which all elevations used in city work are referred. The examination of the records of the Bureau, Acts of Assembly and ordinances of the city indicate that the base was probably established in a somewhat arbitrary manner by some of the early surveyors. The oldest plans of the city and adjoining districts showing elevations, the first of which were made under authority of an Act of Assembly of April 17, 1795, refer to curb heights and other elevations as being "Above the plane of the highest tide that has been noted in the Delaware River," or "Above the plane of the tide." Observations made by the Bureau show that the mean high tide for the years 1900-1904 was —2.31. This mean varies but little from year to year. High tide seldom rises above the plane of "City Datum."

An ordinance of August 6, 1814, directs that "The Mayor, together with the whole of the Regulators to be appointed agreeably to this ordinance shall meet immediately after the appointment of said Regulators and determine on a particular permanent point or mark somewhere near the center of the city, noting such mark in the proper book of reference, and its height above the general plane assumed in the plan now in the city clerk's office, and marking the same in the book of draughts to which the said point or mark shall belong." We have been unable to find any record of these instructions being complied with, but the ordinance is in effect an official confirmation of the "general plane" then used as a base for elevations. The "general plane" established prior to 1799, which was referred to upon all the city plans of that time, and the plane now referred to and known as "City Datum," are identical.

An effort has also been made to determine the elevation of city datum with reference to the base of the United States Coast and Geodetic Survey, which is mean tide at Sandy Hook. This has been done by comparing the elevations of city benches with benches of the Pennsylvania Railroad Company, which uses Sandy Hook datum as a base and has established a uniform system of benches over all its lines. The United States Coast and Geodetic Survey has never run a line of precise levels to Philadelphia, its nearest bench being at Reading, but it has touched upon many benches of the Pennsylvania Railroad, and the check has been sufficiently close, Mr. Webster says, to justify the use of the railroad benches for comparison. This comparison has embraced 38 railroad benches and 64 city benches, the average difference in elevation being 5.5456 ft., the plane of Philadelphia "City Datum" being that much higher than the plane of Sandy Hook datum. The method employed in determining this difference is not such as will warrant the assumption that it is exact, but the determination of the exact difference would require a system of precise leveling which the Bureau has not had time to make.

Laboratory.—The continued increase in the amount of construction work done by the city, through its various bureaus, has led to a still further increase in the capacity and scope of the work of the testing laboratory. New appliances and methods are continually introduced to keep the character of the work up to the requirements of the best practice. One of the additions having an important bearing upon future work was the equipment of a room for the testing of asphalt with electric ovens, mechanical exhaust and blast, and all the other necessary accessories.

The value of material used in public works having been determined to be upwards of $1,000,000, a careful comparison of this with the small cost of maintaining the laboratory, including the salaries of assistants and the new apparatus, shows that the cost of testing amounts to less than 1 per cent. of the value of material used. A comparison with the cost of testing by private laboratories where the charge varies from 2½ to 5 per cent. of the value of materials, shows that there is a great saving to the city in this particular, while the value to the city of obtaining materials of high standard for incorporation into its public works is incalculable. The outcome of the systematic tests of all materials entering into the public works, is the maintenance by the manufacturers of a high grade of materials, and stimulates them to the installation of the latest improved machinery in order to attain this end.

During the year 1,852 shipments of cement have been inspected and tested, 1,372 of which were Portland and 480 natural or improved cements. Each of these shipments has been tested for soundness, tensile strength, specific gravity, time of setting and fineness. Chemical analyses have also been frequently made. The testing of concrete cubes has been a special feature of this year's work, 843 of these tests having been made as against 547 for last year. These cubes are made on the work from the materials in the mixing box, so that the values obtained from them are indicative of the strength of various structures in which they have been incorporated.

A large number of tensile and transverse tests of cast iron have also been made in connection with the pipe system being installed for the distribution of filtered water.

In addition to the foregoing tests which constitute the major part of the work of the laboratory, tests of other materials are frequently made, among which may be mentioned steel, asphalt, wood, stone, building and paving brick, puddle, sand, wire rope, etc. Investigations also are continually being made with a view to obtaining more reliable data concerning the properties of these materials and also for the improvement of the methods of testing employed.

The Resistance of Bends and Elbows in Pipes.

In a paper recently published by the Institution of Civil Engineers, Mr. C. W. L. Alexander describes an experimental investigation of the nature of the resistance offered by bends, knees and elbows to the flow of water through closed pipes, carried out by him in 1901-1902 in the University of Birmingham. The Weisbach formula for the loss of head due to right-angle bends suggests the question whether the loss of head is dependent only on the angle and the curvature of the bend, or whether the resistance is not also dependent on the diameter and the nature of the internal surface of the pipe.

On setting out to find the answer to this question three requisites at once suggest themselves, namely: (1) a series of right-angle pipe-bends, accurately made to given curvatures, with a surface of constant roughness for all, and with each of the bends of full bore throughout and free from every irregularity; (2) a suitable pressure-gauge for measuring exactly the head lost by the water in traversing the bend, and (3) a supply of water sufficient to give a large range of velocities and free from extraneous shocks and disturbances.

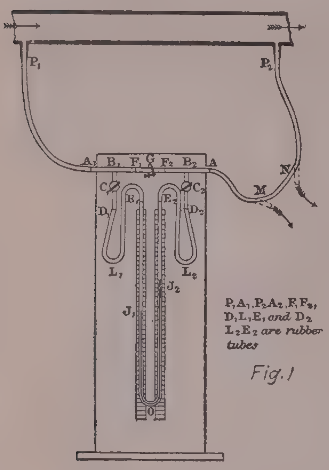
Pipe-Bends.—The provision of the bends required for the experiments proved to be the most serious difficulty. Finally it was suggested by Mr. T. D. Garscadden to make the bends in wood. This suggestion was acted upon, and the pipes were made in half, like a core-box, the material used being pine, cut from planks 1¼ x 11 in. The plank having been first planed to a uniform thickness of 1 3/16 in., two pieces, of the length required for the particular pipe-bend, were cut to a triangular shape, and upon each block thus formed the bend required was marked off accurately in position, as shown. The two halves were then placed face to face, and were bored through with a ½-in. bit. Dowels were then inserted in one half to fit firmly into the holes in the other. The core was then removed from each half with a gouge-chisel, to an accurately made template, so that each half pipe was exactly semicircular in section, any slight roughness left being rubbed down with sand paper, and the halves were fitted together and examined to see that they coincided exactly. They were then given four separate coats of clear shellac varnish, the surface being rubbed with very fine sand paper after each coat, to remove any slight roughness. The pipes thus treated were found to be capable of remaining in contact with water for a lengthened period without swelling or otherwise showing signs of absorption, except where entry to the interior was obtained in one or two instances at screw holes. Ten bends were made in this manner, each 1¼ in. in diameter and with 6 in. of straight pipe on each side of the bend. No. 0, a 39-in. length of straight pipe, was simply made in halves, each of that length. No. 11, an elbow, was made in quarters. The two lengths of pipe were exactly faced and fitted together at right-angles, being held in position by two cover-plates.

For attaching the iron pipes to the wooden bends two gunmetal flanges were provided, each threaded to screw on to the iron pipes and having a lug on either side to fit into corresponding slots in gunmetal seats permanently screwed to the wooden bend.

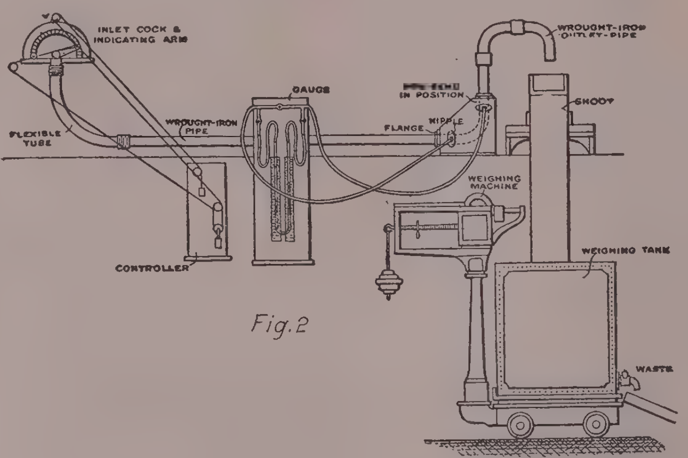
At a distance of 2 in. from each end, in one half of each pipe, a hole ⅛ in. in diameter was carefully bored from the inside, to act as a piezometer tube. The two holes were exactly on the center line, and, after boring, were provided with copper tubing of about 3/32 in. bore, which fitted tightly and was filed off flush at each end so as to cause no disturbance to the flow in the pipe. The object of the copper tube was to prevent water getting into the wood and also to give a clear passage, free from any obstruction, for the water transmitting the hydrostatic pressure. On the outer face of the wooden pipe, over these two openings, were screwed two gunmetal flanges, provided with nipples, to which the rubber tubing from the pressure gauge could be connected.

The accuracy with which these wooden pipes were made may be judged from the fact that a volume test showed the straight pipe to be within 1/400 in. of 1¼ in. in diameter.

Pressure Gauge.—After trials with gauges of various forms, that shown in Fig. 1 was found to be best. $P_1 A_1$ and $P_2 A_2$ are rubber tube connections from the piezometer-nipples to glass T-pieces, $A_1 F_1 D_1$ and $A_2 F_2 D_2$. The ends F_1 and F_2 of the horizontal portions of these T-pieces are connected together by a piece of tubing having a clamp attached midway at G. At C_1 and C_2 are stopcocks, and the lower ends of the vertical parts of the T-pieces are connected by rubber tubes, $D_1 L_1 E_1$, $D_2 L_2 E_2$, to the upper ends of the straight limbs of the glass U-tube, $E_1 E_2$. Behind the vertical branches of the U-tube are two similar glass scales, graduated in millimetres, and silvered on the back to insure accuracy in reading. Before half filling the U-tube with the selected liquid it was thoroughly cleaned by filling it with strong sulphuric acid, allowing it to stand for 20 minutes, and then rinsing out three times with pure distilled water. The two T-pieces having been fixed in position, the ends $D_1 D_2$ were connected, by means of the rubber tubing, to the ends of the U-tube, which was then lowered so as to extend the rubber tubes $D_1 E_1$, $D_2 E_2$ almost vertically and in line with the limbs of the U-tube. With the two cocks and the clamp open and the ends $P_1 P_2$ held high above the rest of the apparatus, pure distilled water was poured in through a funnel at P_1. This ran down $P_1 A_1$, and across to B_1 and B_2, where it made its way down past C_1 and C_2 simultaneously, through the rubber tubing to the heavy liquid, on which it of course floated. The tubes having been thus filled with distilled water from the level $J_1 J_2$ to the level $A_1 A_2$, each portion was fixed in its proper place and the gauge was ready for calibrating. For this purpose a short piece of glass tubing was attached to the end P_2, and was fixed in a vertical position above the level of $A_1 A_2$. To the end P_1 a large glass funnel was attached. This funnel was then fixed on a stand resting on the table of a milling machine. The cocks C_1 and C_2 were closed and water was poured into the funnel till every part of $P_1 A_1 A_2 P_2$ was filled, the water overflowing at P_2 and standing at the same level in the funnel. The clamp G was next closed, and the instrument was calibrated by raising the table of the milling machine through successive measured heights and reading off the corresponding levels of the liquid in the U-tube. A curve plotted with heads of water as ordinates and indicated heads as abscissae gave a straight line making an angle with the horizontal axis, varying with the heavy liquid in the bottom of the U-tube. When the wooden pipes were tested horizontally the nipples were kept downward, because occasionally a large amount of air was present in the water, and this would have got into the rubber tubing and destroyed the accuracy of the readings if the piezometers had been on the upper face. After attaching the tubes to the piezometers, with the cocks $C_1 C_2$ shut and the clamp G open, the rubber tubing was disconnected at the intermediate piece of glass tube $M N$, and the water immediately started to run from M and N. All the air was known to have been expelled when the flow across $A_1 F_1 F_2 A_2$ became unbroken, and the tubes were again connected at $M N$. There was then a practically incompressible fluid from one piezometer through the U-tube or the top cross-connection to the other piezometer. Consequently, with a current through the pipe under test and a correspondingly greater pressure at P_1 than at P_2 there was a slow current through $P_1 A_1 G A_2 P_2$. By shutting the clamp G this current was stopped, and the pressure at B_1 became greater than that at B_2, the difference being indicated by the difference of level of the two columns of the heavy liquid, produced when the cocks $C_1 C_2$ were opened. To make a clearer distinction between the heavy liquid used and the water, the liquids were colored orange-yellow with aniline dye, which is not soluble in water. This was not absolutely necessary, for the surface of separation was a beautifully sharp meniscus, convex to the water, and such that, reading back horizontally to the top of the column reflected in the mirror, it was quite easy to differentiate to 1/100 in.



Pressure Gauge.



General Arrangement of Apparatus for Pipe Bend Tests.

Supply of Water.—Recourse was had to the city main for a supply. The meter house was connected with the laboratory by about 130 ft. of 1¼-in. pipe, and velocities of more than 8 ft. per second were obtainable. Disturbances due to consumers outside drawing off water, however, rendered it impossible to carry on experiments earlier than 6 P. M., so that all readings had to be taken between that time and 7 o'clock next morning.

Arrangement of Apparatus.—The arrangement of the apparatus, set up for investigating the effect of a bend, is illustrated diagrammatically in Fig. 2. As the inlet-cock was some 12 ft. away from the rest of the apparatus and at a considerable height, Mr. Alexander arranged a rude system of pulleys and weights, shown in the diagram, to allow of the water being turned on and off from the gauge. The wooden pipe bend is shown standing vertically, but in most of the experiments the bends were laid in a horizontal position.

Treatment of Results of Experiments.—The direct object of the experiments being to find the loss of head for different degrees of curvature at different velocities, the first thing to be done was to find the curve of loss of head per unit length in a straight piece of pipe. On the straight length of wooden pipe three piezometers were fitted, 379.5 mm. apart. Readings were taken of the loss of head between the two extreme piezometers and between adjacent ones. From the tabulated results the hydraulic gradients for different velocities were obtained, and a curve was plotted with the velocities as ordinates and the slopes as abscissæ. By comparing this curve with a curve having the logarithms of these velocities for ordinates and the logarithms of the slopes for abscissæ, the law connecting the slope with the velocity was obtained.

For the varnished wood pipe described Mr. Alexander found that

$$V = 181.5\, R^{0.61}\, S^{0.56} \text{ feet per second,}$$

so that the curve connecting V and S for the given pipe is a parabolic one, represented by the equation $V^2 = K\, S^{1.12}$.

From the logarithmic homologue it is seen that $\log S/\log V = 1.77$, and it is from this curve that the law is most easily discernible.

Having obtained the loss of head per unit length of straight pipe, a table was prepared showing the loss of head at different velocities for lengths of straight pipe equal to the length of the center line between the piezometers on each of the wooden bends, and from these figures a curve was plotted for each bend. Similarly, curves were plotted showing, for each bend, the actual losses of head between the piezometers, and thus that part of the loss due to the bend could be at once read off, being represented by the difference of the abscissæ of the two curves. When this had been done and the net losses due to the bend had been plotted logarithmically, it became apparent that the index of H in this case was the same as that of S for the straight pipe, showing that the loss of head at the bend is of the same nature as that in the straight and obeys similar laws, and until the bend becomes as sharp as a knee its effect does not partake of the nature of a shock.

Collected Results.—The following are the equations for loss of head at bends which have been deduced by Mr. Alexander from the results of his own investigations, and from the other experimental data available:

For varnished wood pipes—

$$h_B = 1.66\, \rho^{0.83}\, l\, (0.00498)\, v^{1.777}$$

where ρ is not greater than 0.2.

$$h_B = 25.0\, \rho^{2.5}\, l\, (0.00498)\, v^{1.777}$$

where ρ is not less than 0.2 and not greater than 0.5.

For drawn brass pipes—

$$h_B = 3.27\, \rho^{0.83}\, l\, (0.00262)\, v^{1.76}$$

For cast-iron asphalted pipes—

12-in.; $h_B = 12.85\, \rho^{0.83}\, l\, (0.000323)\, v^{1.78}$
16-in.; $h_B = 12.85\, \rho^{0.83}\, l\, (0.000214)\, v^{1.86}$
30-in.; $h_B = 12.85\, \rho^{0.83}\, l\, (0.000117)\, v^{2.0}$

In all these equations the numerical coefficient immediately preceding v is the m in previous equations.

Finally, from a directly practical aspect, the points of especial interest are that a curve whose radius is 2½ diameters offers a smaller resistance than any other curve, and that this resistance is equivalent to that offered by a length of straight pipe given by the equation $L = 3.38\,l$, where l is the length of the curved portion of the pipe measured along the center line.

The Jungfrau Railway.

The completion of the Jungfrau Railway, at least for the present, was marked by the opening of the Eigerwand-Eismeer section on July 25, which reaches an elevation of 3,162 m. above sea level. Eismeer is the highest railway station in Europe, and the highest tunnel station in the world. The road was described in this journal several years ago, but the completion of the first stage renders a brief review of it of timely interest. The project was originated by Adolf Guyer-Zeller, of Zurich, and for some time contemplated a line to the summit of the famous mountain, which has an altitude of 4,166 m. Construction was begun in 1896. The gauge is 1 m. and the road is an electrically operated rack railway, the 7,000-volt current being furnished by a 2,650-hp. hydraulic station and transformed to 600 volts for the line. The maximum grade is 25 per cent., and the sharpest curve has a radius of 100 m.

The road begins at an elevation of 2,064 m. at Klein-Scheidegg, and runs 2 km. in the open, save for a short tunnel at Eigergletscher, a station opened in 1898 at an elevation of 2,323 m. The road then enters a tunnel to be 10 km. long ultimately, 3.7 m. wide and 4.35 m. high. The first section, 0.88 km. long, running to the Rotstock station, was driven from both ends and finished in 1899. The next section, running 1.52 km. to Eigerwand, could be driven only from one end, and was not finished until 1903. Eigerwand is 2,868 m. above the sea level, and is 1.3 km. from the Eismeer station, which was recently opened. The railway has already crossed under the Eiger peak and reached the foot of the peak known as the Mönch.

The general arrangements of the line at present are stated substantially as follows in the "Zentralblatt der Bauverwaltung." The tunnel stations have been blasted in the rock. The roof is supported by masses of rock left standing at intervals of 6 to 8 m. The Eismeer station gives a view of an Alpine basin 8 km. wide and bounded by some of the most famous mountains of the world. It is hoped that by October a means of access to the glacier and a number of sleeping rooms will be completed. A sort of gallery, like the famous Axenstrasse on the Lake of Lucerne, protects visitors from the weather and furnishes a convenient starting point for those who care for snow sports and mountain climbing.

From Eismeer the tunnel will eventually run, if the original project is carried out, to Jungfraujoch, 4 km. distant and 3,421 m. above the sea. From this point a 25 per cent. grade will run to the Jungfrau station, the end of the line, where an electric elevator will lift the visitor to the top of the famous peak. The execution of this costly portion of the line will depend on the financial results attained on the road as far as Eismeer. These are reported, in the journal above named, as favorable. In the first year of operation, when cars ran only to Rotstock, 26,000 passengers were carried, and this number rose to 29,000 when the Eigerwand station was opened.

The tunnel has been driven in hard limestone and no lining is needed. The drilling was done with Siemens & Halske electric machines. In the blasting operations fuses lighting one charge after another gave better satisfaction than electric apparatus. The work was carried on continuously in eight-hour shifts, and has cost to date $1,200,000. The round trip to Eigergletscher costs 60 cents, to Rotstock $1, to Eigerwand $2 and to Eismeer $3.60.

Book Notes.

A useful pamphlet for engineers and architects has been issued by the Bureau of Forestry, which has prepared it in co-operation with the Society of American Foresters. It is a dictionary of the "Terms Used in Forestry and Logging," and not only defines American words, but also gives their German and French equivalents. Lumbermen's slang is not included, nor are the terms used in the mill. On the other hand, many entirely new terms and modifications of those already in use have been included to meet the needs of American forestry.

The New York State Museum at Albany has published, at 15 cents, a valuable monograph on the "Mining and Quarry Industry of New York State," written by Mr. David H. Newland. The industry has materially increased of late, and this report gives a useful summary of its condition last year. Building brick worth $7,473,000 was the leading product, natural and Portland cement worth $2,454,000 came second, limestone worth $2,058,000 came third, and salt worth $2,103,000 was fourth. The value of all the products in 1904 was $27,767,000. The notes concerning the recent developments of various properties are particularly useful to engineers and contractors purchasing many classes of material.

One of the most interesting sewerage systems ever constructed in this country is the joint outlet sewer for eleven separate municipalities in Essex and Union Counties, N. J. The fact that these not entirely harmonious communities voluntarily joined in a rational scheme for disposing of their sewage is the most remarkable feature of the work; there was no legislative compulsion brought to bear, nor was there any threat of legal proceedings. From an engineering point of view, also, the work is of much interest, while the method followed in apportioning the cost between the communities attracted wide attention, for similar joint action is becoming imperative in many other districts. The work was completed a few months ago and an excellent account of its history and engineering features has been written by the engineer, Mr. Alexander Potter. It is published in a profusely illustrated book of 100 pages, containing a large amount of useful data concerning details of design and construction not often mentioned in documents of this nature.

An interesting account of a reinforced concrete reservoir for filtered water, completed last year at Tucuman, Argentina, is given by Mr. Carlos Wanters in "El Cemento Armado en la Republica Argentina." This is a covered circular basin 36.1 m. in diameter and 5.25 m. high to the tops of the columns and wall. The wall is 20. cm. thick and the columns are 25 cm. square, heavily reinforced and beveled at the corners. Twenty-four columns are arranged around the circumference of a circle of 22.5 m. diameter, and twelve on the circumference of one of 9 m. diameter. The columns of each circumference support an annular reinforced concrete girder, and these two rings, with the outer wall, carry the annular vaults forming the roof. The pamphlet contains many drawings and views of the work during construction and after completion, and the details of the steps in the designing of the structure are explained. The author's address is 558 rue Mendoza, Tucumán, of which city he is director of public works.

Mr. Maurice Koechlin, managing director of the Société de Construction de Lavallois-Perret, has written a description of typical French highway bridges bearing the title, "Recueil de Types de Ponts pour Routes." There is a 306-page octavo volume of text and an atlas of eight large folding plates, giving pretty complete drawings of the following spans; Narrow 4-m. span, wide 4-m. span, wide 8-m. span, narrow 10-m. span, wide 15-m. span, narrow 20-m. span, wide 25-m. span and narrow 30-m. span. These illustrate what may be considered typical French plate girder and truss designs. The first chapter of the text is a brief explanation of the types of structures shown in the atlas, the second contains a large number of tables of the properties of built sections which were computed under the direction of Chief Engineer A. Valat of the Eastern Ry. of France, the third chapter is a discussion of formulas used in bridge design, and the remaining chapters explain the details of computation of the structures illustrated in the atlas. The book affords American readers an excellent opportunity of becoming familiar with standard French high bridge practice. It is published by Ch. Béranger, 15 rue des Sains-Peres, Paris.

MACHINE-SHOP TOOLS AND METHODS. By A. S. Leonard, New York, John Wiley & Sons; cloth, 8vo., 562 pp., $4.00.

This book is nominally the third edition of a book previously issued in the form of loose leaves for the students in the mechanical department of the Michigan Agricultural College. Really it is a new work, and a very good one, in its own special field. It is a description of the various tools now used in machine shops and an explanation of their use. Beginning with the gauges, rules, hammers, chisels, files and other hand tools, the author gradually proceeds through drills, lathes, boring machines, planers, shapers, slotters, milling machines, grinding and polishing machines to the final chapters on certain broad principles in shop practice. In all this field the book is essentially descriptive; fortunately no attempt is made to solve the problems facing the designer of machine tools, for this field is already well covered by Mr. C. L. Griffin's "Elementary Textbook on Machine Design." Mr. Leonard's work is based on the assumption that the tools described are well designed and that the reader is only concerned with the way they run and the class of work they will turn out when properly handled.

Some engineers may object strongly to any attempt to teach shop practice by textbooks. It is not the intention of Mr. Leonard to undertake this impossible task, but rather to supply such information concerning the equipment of shops as can be readily understood by anyone. As a matter of fact, all the information in this book should be possessed by every mechanical and electrical engineer, while it is a debatable question whether any more is needed except by those who propose to become shop managers. As for the character of the book, parts seem to be good while other parts relating to the heavy tools are rather sketchy and hardly bring out their merits for special work.

THE CLAY PRODUCTS of the United States reached a valuation of $131,023,000 last year, just a little less than that of 1903. Of this total, common brick amounted to $51,769,000, paving brick to $7,557,000, front brick to $5,560.000, drain tile to $5,349,000, sewer pipe to $9,187,000, fire brick to $11,168,000, architectural terra cotta to $4,107,000, fireproofing and hollow tile to $3,629,000. Ohio leads in the industry and produced wares valued at $25,648,000. Pennsylvania and New Jersey follow in the order mentioned.

Letters to the Editor.

Steam Turbines for Pumping Engines.

Sir:—In a recent issue you presented an editorial concerning turbine pumping engines as compared with the usually employed reciprocating machinery for water works purposes, and made alleged comparisons. As a matter of fact there are no thoroughly adapted turbine pumping engines embodying complete steam and water ends of reasonable dimensions for proper comparisons yet in existence for the service of public water supply where every item going to make up cost of pumping is systematically considered. Of course upon a small scale, turbine pumping is done, but the comparison of such pumping is more with the lower types of steam machinery than with the higher developments of the art. Turbine pumps driven by embryo gearing from steam motors, driven by electric dynamos, and other extraneous methods never will successfully compete with the regularly designed reciprocating steam pumping machinery, and the real issue will be with us when the steam turbine and the turbine pump are coupled together upon the same framing and so form a regular "direct-acting" turbine pumping engine. I have some partially worked out designs of this character but do not as yet see clearly the way to follow to gain advantages over the present standard pumping engine, and perhaps the way never will be found. The turbine idea is in the keeping mostly of large wealthy corporations enjoying plenty of capital and talent and means of determining without cost to the public very many of the points needed to be settled before the "commercial pumping engine" in the turbine form is established in public favor. These companies are thoroughly responsible and their interests are the customers' interests, so we have nothing to fear during the possible evolution and problematical establishment of this form of useful machine.

The tests, however honest and severe, which have been exhibited of steam turbine machinery, have been, neverthless, in the hands of parties interested in the commercial success of the business, and I sincerely trust that I will not be misunderstood when I say that such tests are not strictly satisfactory to would-be buyers, especially in the matter of applying this mode of developing energy from heat to the very important work of putting public water supplies under pressure for distribution or storage. The argument of lower first cost does not attain even to the dignity of being secondary, but occupies a place somewhere down in the fourthlies or fifthlies. And even at this, as the efficiency of the turbine steam engine depends greatly upon high speed of rim, and as the efficiency of the turbine water end of the machine must be pretty closely adapted to the pressure, and as the better efficiencies of the steam factor demands high rim speed while the proper speed of the water factor is considerably lower for the same diameter of machine in a direct connected apparatus, it may follow before we get through with the problem that a steam factor of large diameter in proportion to the power delivered may be necessary to meet successfully the demands and then the first cost will begin to mount higher up. Low first cost is the weakest argument possible to advance in advocating a useful machine, and when such an argument is made prominent it strongly resembles the making of a big smoke to cover a flank movement.

Manufacturers of turbine pumps seem perfectly willing to ship the machines f. o. b. and let the buyer take the chances, but when approached to make a contract anything like as precise as is usually made for the reciprocating machinery, are not so ready to sell, and in some cases, as I know from actual experience, flatly decline. I have tried three times up to date, and am preparing to try again and shall shortly bring forward a brilliant opportunity for the turbine steam pumping engine builders to fall into line with a contract which could be readily made any day with the builders of the regular school. I am in dead earnest about this turbine pumping for water works, and think that such an apparatus would be ideal for handling water under pressure, but my sense of faddism was long ago worn out and refuses to respond to the inductive force in the absence of evidence. After the mind firmly grasps the idea that two and two make four, and the blood is cooled and calmed by experience, the utmost good nature prevails; but the reason demands reasons. If the turbine is the best outfit for water works, nothing can stop it; if it is not the best, nothing can save it.

The steam turbine seems to be ideal for driving electrical machinery, with its faculty of high rotative speed almost without limit, or rather its seemingly perfect adaptation to the speed best suited for the particular case in hand, whether the speed of rotation required is 1,800 or 750 r.p.m., as some recently contracted for apparatus calls for. This 750-r.p.m. machinery just about fits a good many pumping demands, but water pumping calls for low proportionate horse power, and such a combination would run up the cost of installation, which would make the fourthly or fifthly look too queer for serious consideration. It is very easy to see that a big reciprocating steam engine at 75 revolutions, and with a revolving field 25 or more feet in diameter, even though saving 15 per cent. of steam over a rapidly revolving turbine, would have a capital account against it which would more than cover the loss represented by the 18 to 20 lb. of steam per horsepower which the steam turbine really seems to need, if one may judge by the condensing capacity which its installers insist upon having connected thereto.

Heretofore we have been led to believe that marine practice embodied the ideal conditions for turbine steam engines, but recent news tells that the chief engineer of the North German Lloyd Steamship Co., Mr. Struver, will report against the use of turbines for the company's ships upon the ground, among others, that they are not suited for large powers, although good enough for the smaller craft. It is also in the newspapers that the United States naval authorities look distrustfully upon the turbine upon learning that in recent large installations for marine work the consumption of coal was increased 50 tons per day, and a knot an hour was dropped from the speed. Perhaps further development may show that even in the electrical field there may be such a thing as going too far with the turbine idea, but this seems hardly possible in view of the reduction in the size of the electrical apparatus which the turbine renders possible. But so far as pumping water is concerned, positive apparatus will likely excell reactionary apparatus, as the chances to modify the capital account sufficiently to offset the losses in steam economy are not frequent enough to sustain the reactionary contention.

The application of superheated steam and extremely high vacuum which seems to be necessary to the turbine will also set the reciprocating pace a little higher, and although the turbine will have the apparent advantage of heating its feed water from the rejected steam of its auxiliaries, even this is really making a virtue of a necessity under which the reciprocating machine does not labor, and a reciprocating pumping engine without auxiliaries, everything being driven from the main engine and so having the economy of the main unit, but with economizers in the boiler connection, will give results which no plant operating with auxiliaries can reach under similar conditions of environment and work.

It cannot be seen that the future even points to any great improvement in the efficiency of steam or water turbines, especially the former. The principles of the modern milling machine has enabled the steam turbine to spring into the arena full fledged; and the traveling crane and the hundred and one special tool tendencies of the present time, all developed in the older school, the wider spread of technical knowledge, the better development of the drawing room and shop management, etc., gave the steam turbine a chance at its birth which some of the older machines worked along for a hundred years before reaching. A few years ago I prepared for a technical journal an article on slide valves, and after finishing it it looked so trite that I thought it would be rejected, but it was gladly received and published, even being copied extensively in Europe. Upon inquiring of the initial publishers why this popularity, the answer was that although the subject was old, new readers were coming forward all the time. And so some of the turbine advocates mistake the triteness and readiness of the machine shop of the present day, for marvelous development of a wonderful machine. But let the good work go on. In fact it cannot be stopped. The eternal fitness of things technical, mechanical and financial will always balance the scale in the long run.

Yours resp'y, Chas. A. Hague.
New York, Aug. 12.

Properties of a Circle.

Sir:—In your issue of July 22d, of this year, we find a letter signed by Mr. N. Spofford, in which he gives a method for finding the radius of a circle, when the length of a chord and the rise of a segment are known. This formula Mr. Spofford was unable to find in any engineering handbook. This rule was printed in the first edition of the Building Trades Pocketbook six years ago, published by the International Textbook Co. of Scranton, Pa. It can, without doubt, also be found in other good engineering books.

Very truly yours, John M. Maris.
Scranton, Aug. 7.

The Manhattan Bridge.

Sir:—I beg leave to call your attention to an error in the editorial article in your issue of August 12th, on "The Manhattan Bridge." The article states that "the construction of this bridge with the towers so narrow longitudinally of the structure, necessitated by the original design of rocking towers, will furnish a course of highly interesting observations as to the movements of the saddles under varying conditions of stress in the cables. The saddles resting on 9-in. segmental rollers have a length of base of 30 ft., parallel to the axis of the bridge. The towers themselves, however, have a width of less than 20 ft. where the roadway pierces them," etc. You have confused the saddles of the anchorage abutments with the tower saddles. The tower saddles are 11 ft. long on the base and are fixed to the towers, and are not on rollers. The towers are designed to bend and thus provide for all the movements under extreme conditions of load and temperature, which are usually provided for by the rolling of the saddles. While the actual conditions are quite apparent upon examination of the plans, your statement might possibly lead to a misunderstanding in some other quarters, and it would, therefore, be well to correct it in your next issue.

Yours truly,
R. S. Buck, Consulting Engr.,
New York, Aug. 14. Dept. of Bridges.

CURRENT NEWS SUPPLEMENT

AUGUST 19, 1905.

DIRECTORY OF NATIONAL TECHNICAL AND TRADE SOCIETIES.

American Society of Civil Engineers, Secretary, Chas. Warren Hunt, 220 West 57th St., New York.

American Society of Mechanical Engineers. Secretary, F. R. Hutton, 12 West 31st St., New York.

American Institute of Electrical Engineers. Secretary, Ralph W. Pope, 95 Liberty St., New York.

National Fire Protection Association. Secretary, W. H. Merrill, Jr., Chicago.

American Institute of Mining Engineers. Secretary, R. W. Raymond, 99 John St., New York.

American Institute of Architects. Secretary, Glenn Brown, Washington, D. C.

Association of Engineering Societies. Secretary Frederick Brooks, 31 Milk Street, Boston, Mass.

American Society of Heating and Ventilating Engineers. Secretary, W. M. Mackay, 235 Water St., New York.

Canadian Society of Civil Engineers. Secretary, Clement H. McLeod, 877 Dorchester St., Montreal.

American Public Health Association. Secretary, Dr. C. O. Probst, Columbus, O. Annual meeting, Boston, Sept. 25-29.

Society for the Promotion of Engineering Education. Secretary, Prof. M. S. Ketchum, University of Colorado, Boulder, Colo.

American Society for Testing Materials. Secretary, Prof. Edgar Marburg, University of Pennsylvania, Philadelphia, Pa.

American Society of Municipal Improvements. Secretary, George W. Tillson, Room 12, Municipal Building, Brooklyn, N. Y. Annual meeting, Sept. 5-9, Montreal.

Association of Railway Superintendents of Bridges and Buildings. Secretary, S. F. Paterson, Concord, N. H.

American Railway Engineering and Maintenance of Way Association. Secretary, L. C. Fritch, 1562 Monadnock Block, Chicago.

American Water-Works Association. Secretary, J. M. Diven, Charleston, S. C.

American Foundrymen's Association. Secretary, Richard Moldenke, P. O. Box 432, New York.

Engine Builders' Association of the United States. Secretary, J. L. Lyle, 39 Cortlandt St., New York.

American Public Works Association. Secretary, W. H. Flint, Chattanooga.

Association of American Portland Cement Manufacturers. President, J. B. Lober, 1232 Land Title Building, Philadelphia.

NOTES ON PRODUCER GAS.

The management of gas producers is discussed at length in a useful book recently published by the Morgan Construction Co., of New York, and among the contents are the following notes of general interest:

Coal.—The coal to buy in any locality is that which by analysis or calorimeter test shows the most heat units for a dollar. This is true for producer gas, providing the producer is capable of gasifying the cheap coal without extra labor, because the process is one of oxidation as well as distillation; consequently the solid carbon or coke is as fully utilized as the distillates. For this reason it rarely pays to buy gas coal unless it can be had at a moderate extra cost over the ordinary steam bituminous grade. For very high temperature melting operations, however, a fairly high percentage of volatile matter is necessary, owing to the fact that it gives a more luminous flame and so intensifies the radiation from the roof of the furnace, which enables the heating effect to be concentrated on a smaller area. For this reason anthracite coal is not useful in high temperature work, although where cheap enough it has advantages for moderate heats.

It is usually best to use run-of-mine, crushed at the mine to pass a four-inch ring or mesh. This grade can generally be obtained at the lowest price; but it sometimes happens that a 1¼ to 2-in. screened nut is offered at the same as or less cost than run-of-mine, in which case the smaller size, freed from dust in the screens, is the more desirable.

It never pays anywhere to use strictly slack coal, although many try it for a while, thinking that the lower first cost is clear gain. It does not prove so, for the reason that the capacity is cut down by choking the blast, which has to be driven at high pressure to get through the fire. This invariably results in overheated gas and consequent loss of efficiency as well as greatly increasing the labor per ton of coal.

Sulphur and Ash.—Sulphur usually occurs as iron sulphide, which melts easily and acts as a molten binder or nucleus around which clinker is formed; hence sulphur is the greatest enemy of the gas producer, just as it is to a grate fire. Generally speaking, sulphur up to 1 per cent is harmless, but beyond that its influence is bad and should be considered, in choosing the coal, as of far more detriment than ash. A coal with large percentage of ash works easily in a good gas producer providing the sulphur is not over 1 per cent, but with high ash and high sulphur the labor of working the fire is very largely increased.

One of the most important matters to provide for in the construction of a good gas producer is perfect facility for removal of the ash without having to bar it through grates or work it dry through doors or over any moving parts. The result of avoiding these complications is not only simplicity and reduction of labor, as referred to elsewhere, but a very tangible and continuous benefit in avoiding loss of fuel in the ash and in the form of unburned coke.

This loss is often an astonishing one, in some recorded cases in regular practice reaching 25 per cent of the whole heat value of the fuel. In some types a great loss by unburned fuel is unavoidable, especially when clinkering coals are used.

Clinker.—When firing is done by hand the surface and density of the fuel bed are very irregular, and are made more so by the continual barring which has to be done. The blast cuts through in spots, which results in chimneys of burning gas in which the clinkers are rapidly formed and gather in large molten masses. This action is frequently augmented by sloping grates or other devices which introduce the blast nearer to the surface at some points than at others.

It is worth noting that these same physical conditions which produce large clinkers also produce high percentages of carbonic acid; the two go together, and are the result of burning the gas in the producer. Even if the clinker-forming elements are absent, as in good coals, yet excess of CO_2 will still be formed by hand-charging, with corresponding loss of efficiency.

When the coal is of good quality (that is, low in sulphur and ash) the difficulties due to clinkers are not so apparent, but when low-grade coals have to be handled the difference in results of different types of producers is very great indeed.

Carbon dioxide.—There is always a certain amount of CO_2 formed, even in the best practice; in fact, it is inevitable, and if kept within proper limits does not constitute a net loss of efficiency, especially with very short gas flues, because the energy of the fuel so burned is represented in the sensible heat or temperature of the gas, and results in delivering a hot gas to the furnace. However, the loss increases rapidly above 4 per cent of CO_2 even when the gas is carried hot in short flues. If too hot, the hydrocarbons are broken up and deposiit their carbon as soot, and the loss from radiation is very great. If attempt is made to run too cool, by increasing the proportion of steam, the result is equally bad, as a low gas temperature permits the deposition of tar in the flues, and both the heating value and capacity are largely reduced. The best result is at about 4 per cent CO_2, a gas temperature between 1100° and 1200° and flues less than 100 feet long.

Steam is a most important factor in the economical formation of the gas. Formerly air alone was blown into gas producers, and as the only function of the air is to supply oxygen, of which it contains only 21 per cent by volume, it is evident that the other 79 per cent (nitrogen) has to be carried in also, and acts only to dilute it, being itself inert and unable to promote combustion. For this reason, the less air we use the less our gas will be diluted with useless nitrogen. It is possible to obtain some portion of the necessary amount of oxygen from steam, but unfortunately not more than about one-fourth of the total, for the reason that it requires so much heat to break up its union with hydrogen, which diminishes the temperature of the fire. So long, however, as a bright heat is maintained, the introduction of steam is of benefit in several ways: principally in diminishing the amount of nitrogen carried in, as already explained; in giving combustible hydrogen gas in return for the heat absorbed in its separation; by enabling a producer to work at a much higher rate without overheating; and lastly, by softening the clinkers.

A cubic foot of hydrogen has the same heat value as a cubic foot of carbon monoxid, and its formation from the steam doubly enriches the gas because it displaces twice its own volume of nitrogen.

It is useful to know the amount of steam required to blow a gas producer. This is found to be from 33 to 40 per cent of the weight of the fuel gasified. The Morgan Construction Co. has conducted a number of experiments on this subject, which enable it to state that good incandescence is maintained when the steam carries in about one-fourth of the oxygen. If the coal were all carbon and burned wholly to carbon monoxid (CO) then the relation between the weight of the coal and the oxygen would be as 12 to 16; that is, 12 lb. of carbon consume 16 lb. of oxygen in burning to CO. Of this 16 lb. we can supply 4 lb. by steam; namely, one-third of the weight of the coal.

The oxygen in steam is eight-ninths of its whole weight, and a bituminous coal requires 8 to 10 per cent more oxygen than pure carbon, on account of its hydrogen content. These two considerations would both increase the relative weight of steam required, but they are about evenly offset by the fact that the coal carries a certain percentage of ash and that a portion of the volatile matter is driven off without consuming oxygen. It is therefore safe to assume that the weight of steam required will lie between 33 and 40 per cent of the weight of the fuel. If 30 lb. of steam is called a standard horse-power, we have therefore to provide about 1 hp. of steam for every 80 lb. of coal gasified per hour or for every ton of coal gasified in 24 hours.

Nitrogen.—It is worth while to get a more definite idea of the real effect of nitrogen. In the original Siemens air-blown producer about 70 per cent of the whole gas was inert and 30 per cent combustible. Then with the advent of steam-blown producers the dilution was reduced to about 60 per cent. with 40 per cent. combustible. Now, under the system of automatic feed, uniform conditions, perfect distribution and adjustment of the steam blast here presented, the Morgan Co. is able to reduce the nitrogen to 50 per cent. and sometimes less.

Taking only 50 per cent. inert gas, let us see how much heat is absorbed in raising its temperature to that of the furnace. It enters the producer cold and is there heated to 1200° F., of which it loses about one-half in passing through the flues; then it passes to the furnace and is further heated to about 3000° F. (as in melting steel or glass). Hence its temperature has to be raised a total of $3000+600-60=3540°$ (reckoned from 60°). In the best practice the volume of gas from the producer is now reduced to about 60 cu. ft. per pound of coal, of which 30 cu. ft. are nitrogen. These volumes are measured at 60° F.

In melting a ton of steel, average practice requires about 800 lb. of coal; hence there is carried into the furnace with the gas $800 \times 30 = 24{,}000$ cu. ft. of nitrogen per ton of steel melted, in addition to that brought into the furnace by the air for combustion, which is not less than two and one-half times that amount, and usually more. The total amount of nitrogen, therefore, cannot be less than 84,000 cu. ft., which is about 6,720 lb., and this amount of inert gas has to be raised a total of 3540° F. For this range of temperature the average specific heat of nitrogen is 0.333; hence the total heat consumed will be $6720 \times 0.333 \times 3540 =$ nearly eight million British thermal units, which is fully three-fourths of the total heat value of the coal burned. Of course all this heat is not wasted, because a large proportion, over one-half usually, is recovered and restored to the furnace by the regenerators, which use the waste heat to warm up both the air and gas before they actually reach the furnace proper; the balance, however, is lost in the large volume of hot dead nitrogen gas which passes into the stack, carrying away heat toward the generation of which it has not contributed in any way.

Hot Gas.—It is important to recognize that a large proportion of the energy of producer gas lies in its sensible heat, which is all lost if the gas is allowed to get cold before using. In the original system of Siemens this loss was very great indeed, from two causes: First, no steam was used, consequently no hydrogen was formed and (if the coal be considered as all carbon) the whole energy of combustion to CO was delivered in the form of heat in the gas; second, the whole of this heat was dissipated in cooling towers and the gas used cold so as to condense it and carry the most possible in the smallest pipes. The heat of combustion of carbon to CO is one-third of the whole heat available in the fuel when completely burned to CO_2, consequently this original system started with a loss of 33 per cent. Now, however, both of these sources of loss are largely reduced: First, by using steam mixed with air in the blast, whereby some of this heat is absorbed in breaking up the steam into its component parts of hydrogen and oxygen, thus giving the hydrogen in the place of some of the heat so absorbed instead of allowing it all to be lost; second, radiation loss is also reduced by lining the flues with fire-brick and making them just as short as possible. The most economical results are obtained with the shortest flues, and wherever possible it is good practice to put the gas producers close up to the furnace for this reason. It is not always convenient or possible to do so, however, as there are, in large equipments, usually other limiting conditions, especially with regard to facilities for handling the coal economically all at one point adjacent to the railroad track. The loss is, however, reduced to a minimum by lining the flues, and very satisfactory efficiency is obtained even with flues several hundred feet long so lined.

The temperature of the gas leaving the producer under best modern conditions is about 1200° F. It can be run cooler than this, but not very much, except at a sacrifice of both quantity and quality. At this temperature, the sensible heat carried by the gas is 1200×0.35 (average specific heat) $= 420$ B.T.U. per pound. As one pound of good gas is about 16 cu. ft. and carries about $16 \times 180 = 2880$ heat units at normal temperature, we see that the sensible heat carried away represents over 14 per cent. of the combustive energy, which is much too large a percentage to lose whenever it can be utilized by using the gas at the temperature at which it is made.

THE PERCIVAL REINFORCED CONCRETE TIE.

The accompanying illustration shows a short length of track of the Galveston, Houston & Henderson R. R. at Galveston, containing a number of reinforced concrete ties of a type designed by Mr. H. E. Percival, of the Percival Wood Preserving Co., of Houston. It is a solid tie, no steel being exposed anywhere, and it has a special variable cross-section in order to keep it from becoming center-bound and thus subject to unequal settlement.

In order to make an 8-ft. block of solid concrete strong enough to withstand the strain which comes on a railroad tie, the form must be of such shape, the inventor states, as to distribute the eccentric pressure, which has been accomplished in this tie, by cutting away the center for 4 ft., making it V-shaped. The ends are made oval, to give a much wider bearing for the distance of 2 ft. at each end. The dimensions of the tie are 8 ft. length, 9¼ in. face, and 9 in. depth. The form of tie makes it a self-tamper, and thus a source of economy in maintenance.

Under the rail is a 2 x 9 x 14 in. wood cushion, which has previously been treated with a high-class wood preserver; this cushion supplies the resilient quality, heretofore found only in the wood tie, and is made in such shape as to readily give to the weights as they strike the rails.

In fastening the rail to the tie, use is made of a screw spike 10 in. long and ⅞ in. in diameter. This spike passes through the wood cushion, and screws down into a socket in the tie filled with a composition of galvanized steel and babbitt.

The reinforcement consists of three ½-in. longitudinal bars in the top, one at each corner and one midway between them; a ¾-in. bar at the bottom, and wrappings of 3/16-in. wire, 16 in. apart, around the four bars. The bars are all of the Johnson corrugated type.

BUSINESS NOTES.

The Midland Steel Co., Pittsburg, Pa., who are to erect a large blast furnace plant at Midland, Pa., have placed contract with Wm. B. Scaife & Sons Co., Pittsburg., Pa., for six steel frame buildings; also crane runways, etc. A very large tonnage of structural shapes and plates will be required in this construction.

The Foster Engineering Co., Newark, N. J., reports that their pressure regulators are proving exceptionally successful in plants where it is necessary to reduce the pressure of air or steam from the high amount which is most economical for distribution to the low pressures used for working purposes. The company's Class W regulator has its pressure-governing valves controlled and operated by the movement of a diaphragm, opposed to the action of springs, whose tension is adjusted according to the delivery pressure to be maintained. This pressure is entirely independent of pressure in the supply pipe. This device is only one of a large number described in the new catalogue of the company.

The Chicago Pneumatic Tool Co. calls attention to a typographical error in the review of its financial statement printed last week. The surplus carried forward is $151,460.86 instead of $15,460.86, as reported.

PERSONAL NOTES.

Mr. Frank P. Dare has been elected superintendent of the water works of Brookville, Ind.

Mr. William Tunstall has been appointed superintendent of public works of Homestead, Pa.

Mr. J. G. White, of J. G. White & Co., sailed for Europe on Aug. 15.

Dr. Myron S. Falk, of New York, has been appointed consulting engineer of the New York State Water Commission.

Mr. G. Williams, Jr., has been promoted to the position of mechanical engineer of the Great Northern Ry., with headquarters at St. Paul.

Mr. A. C. Butterworth, of the Wabash R. R., has been promoted to the position of assistant engineer in charge of the construction of the Landers yard at Chicago.

Mr. F. E. Watson, Albion, Neb., has been appointed an assistant engineer on the staff of the Isthmian Canal Commission.

Mr. W. R. Sanborn has been appointed assistant engineer of the Indiana, Illinois & Iowa R. R., at Kankakee, Ill.

Mr. Thomas Preer has resigned his position as superintendent of the Columbus (Ga.) Water Co., in order to move to New Mexico.

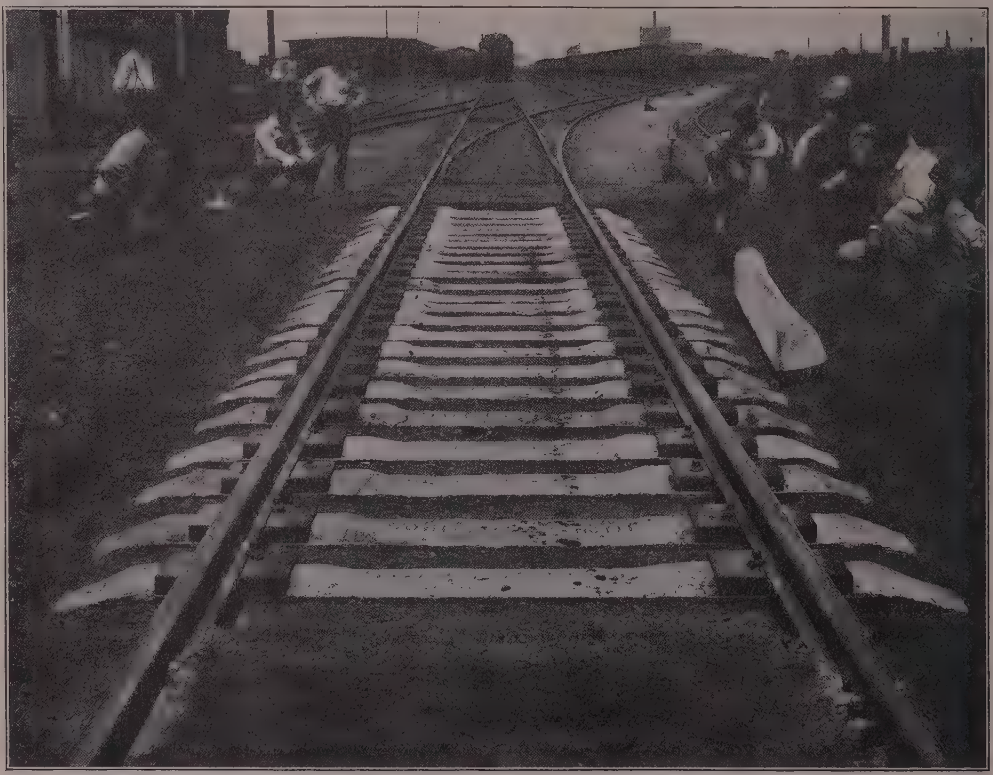
Mr. W. E. Dauchy, who has been the division engineer at Culebra of the Isthmian Canal Commission, has resigned that place and returned to the United States.

Mr. William H. Cushing, resident engineer on the barge canal improvements at Fulton, N. Y., has resigned in order to take up private work at Huntington, Pa.

Mr. E. F. Vincent has been promoted from the position of chief draftsman, chief engineer's department, Missouri Pacific Ry., to that of assistant engineer, at St. Louis.

Mr. Felix F. Wiener, vice-president and treasurer of Henry Pels & Co., 68 Broad St., will visit Europe shortly and in his absence Mr. I. Maddaus, secretary, will be in charge of the company's offices.

Mr. Luigi Luiggi, who recently completed the naval harbor works of the Argentine Republic, has been appointed by the Italian Government State Councillor for the management of the railways of that country.



THE PERCIVAL REINFORCED CONCRETE IN THE GALVESTON, HOUSTON & HENDERSON TRACK AT GALVESTON.

On Sept. 13 and 14 the U. S. Civil Service Commission will hold examinations of candidates for the position of constructing engineer of the water and sewerage system at Manila, P. I.

Mr. Hugh Wilson, recently appointed division superintendent of the Missouri Pacific Ry., with headquarters at Carthage, Mo., is a graduate of the engineering department of the University of Nebraska who began work only six years ago as a section hand on the Burlington system.

Dr. G. G. Revay, of 45 Cedar St., New York, who controls the American rights to the Coppee coke oven, has sailed for a prolonged business trip in Europe. It is understood that several large plants of this type are to be constructed in this country for the recovery of by-products.

Mr. W. C. Barrett, assistant division engineer of the Baltimore & Ohio R. R. at Grafton, W. Va., has been transferred to Newark, O., and will be succeeded by Mr. F. H. Koppes. Mr. A. S. Wordle has been appointed engineer of maintenance of way at Wheeling, W. Va., to succeed Mr. J. T. Wilson, who has been transferred to Baltimore.

The Iroquois Construction Co., which is building the electric generating plant of the Niagara, Lockport & Ontario Power Co., has elected Gen. Francis V. Greene president; F. B. H. Paine, formerly export manager of the Westinghouse Electric Co., vice-president and chief engineer; Robt. C. Board, secretary, and Clifton Hubbell, treasurer. R. D. Mershon remains the chief electrical engineer of the Niagara, Lockport & Ontario Power Co. The offices of the Iroquois Construction Co., following the election of the new officers, are moved to the Fidelity Building, Buffalo.

Andrew Fletcher, of the W. & A. Fletcher Co., of Hoboken, N. J., died Aug. 7. In 1853 he founded the firm of Fletcher, Harrison & Co., machinists, which lasted until 1881, when Mr. Harrison withdrew and the present firm was organized to continue the business. The original home of the business was New York, and there it built the "Mary Powell" and other fast boats on the Hudson and Long Island Sound. Since moving to Hoboken the company has been equally successful with this class of vessels, the famous "Priscilla" being its best known achievement.

Mr. R. W. Christian, the well-known gold dredge operator of Gold Creek, Ore., has been retained by the Allis-Chalmbers Co., Milwaukee, to give advice on placer dredging to the company's customers. He may be addressed directly or through the company. At present he is changing over his dredge at Gold Creek from steam to electric power.

The new yards of the Missouri Pacific Ry. at Kansas City, Mo., will be constructed under the direction of Mr. Herbert Murphy, recently appointed division engineer at that city. Mr. J. H. Johnson has been appointed assistant engineer at Nevada, Mo., and Mr. S. H. Busby division engineer at Ft. Smith, Ark., and Mr. C. H. Cotton division engineer at Vidalia, La.

Mr. Walter E. Harrington, whose resignation as vice-president and general manager of the New York & Philadelphia Co. was mentioned in the issue of this paper for July 29, has become associated with J. G. White & Co., of New York, as operating manager. In this capacity Mr. Harrington will supervise all of the railway, electric light, gas and other properties in which J. G. White & Co. are very largely interested all over the world, and will make his headquarters at the New York office of the company. Mr. Harrington has been prominent as a street railway manager and is known most widely through his connection with the Camden & Suburban Railway Co., of which he was general manager and vice-president for the eight years ending in 1904. In the latter year this property was purchased by the Public Service Corporation, and Mr. Harrington was immediately placed in charge of all of the railway properties south of Trenton belonging to this company. In 1905 he assumed charge of the New York & Philadelphia Co. as vice-president and general manager, but remained with this company only a few months. Mr. Harrington is an active member of the executive committee of the American Street Railway Association, has served on the standing rules committee of the association for several years, is a member of the American Institute of Electrical Engineers, and has acted as consulting engineer for a number of street railway systems. The appointment to his new office dates from Aug. 1.

CONTRACTING NEWS

OF SPECIAL INTEREST TO CONTRACTORS, BUILDERS, ENGINEERS AND MANUFACTURERS OF ENGINEERING AND BUILDING SUPPLIES.

WATER.

Notes Arranged Alphabetically by States.

Gilroy, Cal.—See "Power Plants, Gas and Electricity."

Los Angeles, Cal.—The question of supplying Los Angeles with water from Owens River is reported to be under consideration by the Council.

Santa Rosa, Cal.—The question of installing a pump at the water works is under consideration. L. E. Ricksecker, City Engr.

Turlock, Cal.—It is stated that bids will be received until Sept. 5 by the Turlock Irrigation Dist., John L. Brown, Secy., for repair work on irrigation canal.

Greenwich, Conn.—Bids will be received until Aug. 25 by A. B. Hill, Engr., 100 Crown St., New Haven, Conn., for constructing a concrete dam containing about 2,500 cu. yds. for the Greenwich Water Co., as advertised in The Engineering Record.

Torrington, Conn.—The Torrington Water Co. has purchased Marshall Lake and will lay a pipe about 3 miles to connect with the main at West Torrington. The supply of this lake is estimated at about 5,000,000 gals.

Westport, Conn.—About $10,000 worth of improvements will be made by the Westport Water Co. (Fred. B. Hubbell, Supt.).

Palatka, Fla.—Wm. W. Lyon, of Palatka, is preparing plans for water works for Palatka, to cost $60,000.

Atlanta, Ga.—The House has passed a bill appropriating $75,000 to provide a new water works system for the State Sanatorium. It is probable that a private plant will be constructed to be owned by the Inst.

Alton, Ill.—The City Council has adopted a recommendation of the Water Works Comn. authorizing the issuance of bonds to enable the city to acquire a municipal water plant.

Bloomington, Ill.—The following are the bids received Aug. 4 for constructing a reservoir of 10,000,000 gals. capacity: Melluish & Thompson, Bloomington, $28,247; Ward & Co., Bloomington, $37,962; Kansas City Constr. Co., $55,586 and $53,586; Crescent Stone Co., Peoria, $39,495 and $40,495; Joseph Cody & Son, Peoria, $47,000 and $35,000; Bansau & Co., Bloomington, $34,000. The bids varied according to the kind of stone or gravel to be used in the construction. The plans of the lowest bidders call for a basin to hold over 10,000,000 gals., which is to be rectangular in form. The excavation will be 16 ft. and a bank 8 ft. above the ground line. The entire basin will be lined with concrete up to 4 ft. below the water line and from that plan on up asphalt will be used to prevent the reaction of frost when the water freezes in the winter. The ground line of the excavations is 330 x 260 ft. The sides slope 44 ft. from the top of the water line to the bottom, and there is a flat space on top which forms the bank 10 ft. wide. The dirt from this slopes 44 ft. to the ground level, making the bank from the bottom of the reservoir to the outside ground 98 ft. wide. The total water depth of this plan is 24 ft., 16 ft. excavation and 8 ft. depth formed by the bank of earth thrown up.

Bradley, Ill.—It is stated that bids are wanted until Aug. 26 for 4 and 8-in. mains, 36 hydrants, etc.; for the water works; probable cost, $16,000. Geo. C. Morgan, Engr., 169 Jackson Boule., Chicago; Eben B. Gower, Town Atty.

Chicago, Ill.—In the report of the Comn. on High Pressure Water Systems, appointed by Mayor Harrison for the years 1903 to 1905, it is recommended that provision be made this year for the system, as follows: $450,000 for South Side section, $200,000 for the West Side section, $175,000 for the North Side section, and $125,000 for a pumping station. Appropriation is recommended for immediate construction of the proposed district at Blue Island Ave. and 22d St.

Doquoin, Ill.—The City Council is considering the granting of a franchise for the construction of a system of water works and sewerage. Geo. C. Morgan, of Chicago, Ill., is said to be investigating the proposed supply of water before drawing plans of that portion of the city to be supplied by the system.

Elgin, Ill.—The construction of a standpipe here has been postponed for the time. R. R. Parkin, Supt.

Quincy, Ill.—Geo. Schlag, Ch. of the Fire Dept., has recommended the installation of a number of additional fire hydrants.

Columbus, Ind.—Geo. Vorwald, City Clk., writes that it is not proposed to construct a filtration plant at Columbus.

Marion, Ind.—Bids will be received until Aug. 22 by the Bd. Pub. Wks. for constructing a 2,000,000-gal. reservoir. F. E. Petrie, City Engr.

It is stated that bids will be received until Aug. 29 by the Bd. Pub. Wks. (John O. Wilson, Clk.), for laying water main extensions in several streets.

New Castle, Ind.—E. M. Glomell, City Engr., writes that the city will not contract for constructing the proposed reservoir, but will do the work themselves.

Ames, Ia.—Bids will be received until Sept. 4 by the City Council for the construction of an extension to the water works, to consist of 4 miles of water mains, a steel tank, a concrete surface reservoir, a 10-in. cased well, etc., as advertised in The Engineering Record.

Davenport, Ia.—The City Council has passed an ordinance calling for the laying of water mains in S. 18th St. and sewer pipe in S. 16th St.

The Water Wk. Com. has recommended to the City Council the purchase of an 8,000,000-gal. hydrant pumping engine.

Baltimore, Md.—The southwest part of the city is reported to be in need of fire protection and the Water Dept. has recommended to the Improv. Com. of the Fire Dept. the need of 756 new hydrants.

Baltimore, Md.—It is stated that an ordinance is to be introduced in the Council providing $40,000 for the Western Maryland fund for the use of the Water Dept. in finishing the work started in the new Dist.

Agawam, Mass.—J. W. Hastings, Town Clk., writes that it is proposed to establish a water system in the Mitteneague District. For further information, address H. E. Bodurtha, of Agawam, Water Comr.

Gloucester, Mass.—The City Council, it is reported, has appropriated $30,000 for improvements to the water works.

South Framingham, Mass.—At the town meeting Aug. 7 it was voted to issue $50,000 bonds for the extending of the water system to Sexonville.

Fairview, Wayne County, Mich.—The City Council has decided to issue $25,000 bonds to extend the water system.

Grand Rapids, Mich.—Bids will be received until Aug 25 (readvertisement) by the Bd. Pub. Wks. for constructing a standpipe or elevated tank of concrete steel or steel 80 ft. high and 50 ft. in diameter for the waterworks, as advertised in The Engineering Record.

Hubbell, Mich.—Plans have been completed by C. B. M. Craig, for the water system which it is proposed constructing here. The cost of the entire system, including reservoirs, pumping station and about 15,000 ft. of 4, 6 and 8-in. pipe, is estimated at about $22,000. A meeting of the taxpayers is to be held soon to decide upon the construction of the system.

Barnesville, Minn.—All bids received Aug. 5th for constructing water works have been rejected and new bids are to be received Sept. 1. M. P. Philippi, City Clk.; M. A. Earl, Engr., 1416 1st Natl. Bank Bldg., Chicago, Ill.

**Clinton, Minn.*—R. H. Chapman, of Ortonville, it is reported, has received the contract to construct water works extensions, including a new pumping engine, at $6,300.

Clinton, Minn.—Bids will be received until Aug. 26 by the Village Council (J. L. Erickson, Pres.) for $6,000 bonds for a water works system.

Columbia Heights, Minn.—The Village Trus. are considering the construction of a distributing system to the Minneapolis reservoir, in order that Minneapolis may furnish Columbia Heights with water.

Detroit City, Minn.—It is reported that bids will be received until Aug. 22 by the Water and Light Comn. (G. C. Nunn, Secy.) for laying water mains.

Duluth, Minn.—The City Engr. has been instructed to prepare plans for an inlet and outlet main at W. Duluth reservoir and the old reservoir, and for the raising of the 15th Ave. east reservoir about 6 ft. to put it on a level with the main reservoir at 33d Ave. E.

East Grand Forks, Minn.—Contracts will probably be let in September for the construction of water works. Engineer, F. W. Cappelen, of Minneapolis.

**St. Martin, Minn.*—J. Diedrichs, Village Recorder, writes that H. J. Berwin, 394 Exchange St., St. Paul, has received the contract for the steel tower, etc., for fire protection, at $2,425 (bids received Aug. 12).

Grenada, Miss.—Improvements are to be made to the water works at a cost of $25,000. C. B. Bolton, Supt.

Houston, Miss.—See "Power Plants, Gas and Electricity."

Columbia, Mo.—See "Power Plants, Gas and Electricity."

Jackson, Mo.—Contracts will probably be let in September for the construction of water works to cost about $30,000. Engineer, Hiram Phillips, Frisco Bldg., St. Louis.

Great Falls, Mont.—The Engineers have passed on the plans of S. B. Robbins, engineer in charge of the Sun River irrigation project and the work will now be hurried to completion. Drilling for dam sites has been ordered.

Helena, Mont.—A committee of 3 aldermen has been appointed by the City Council to investigate the feasibility of a municipal new water system, the source of supply to be Lake Hauser, which will be formed by the building of a second dam acrosss the Missouri River.

Arlington, Neb.—The citizens have voted in favor of issuing $13,500 bonds for constructing water works. M. A. Earl, Engr., 1416 1st Natl. Bank Bldg., Chicago, Ill.; B. F. Hadley, Clk.

Auburn, Neb.—See "Power Plants, Gas and Electricity."

Benson, Neb.—The citizens on Aug. 1st voted in favor of issuing $20,000 bonds for constructing water works. F. S. King, City Clk.

Lincoln, Neb.—Plans and specifications have been approved for the reservoir, which is to cost about $15,000, and the City Engr. will soon ask bids for the construction of same. Plans have also been approved for the pump house, which is to cost $4,500.

Norfolk, Neb.—It is stated that bids will be received by Julius W. Hulff, City Clk., until Sept. 7 for extending water mains, etc.

Cranbury, N. J.—W. E. Sexton, 1910 Market St., Philadelphia, and C. S. York have been engaged jointly to prepare plans, specifications and superintend the construction of a system of water works at Cranbury for the Cranbury Water Co., and bids for the construction of same will be called for in about 3 weeks.

Ft. Hancock, N. J.—It is stated that bids are wanted until Sept. 11 for sinking a tubular deep well at this point; Abe. S. Bickham, Q. M.

Newark, N. J.—The Bd. of Wks. has authorized Ch. Engr. Sherred to estimate the cost of extending the high-pressure system in that section east of the Pennsylvania R. R.

Plainfield, N. J.—It is stated that it is probable that a special election will be held to vote on the question of municipal control of the water supply. The advisory com. of the engineers, which consists of J. O. Osgood, of North Plainfield, Ch. Engr. of the New Jersey Central R. R.; Wm. L. Saunders, Pres. of the Ingersoll-Rand Drill Co., and Benj. S. Church, of N. Y. City, in their report to the City Common Council recommend that the plant of the Plainfield Water Supply Co. be obtained at a reasonable cost, either by purchase or condemnation, and also suggests that should it be impracticable to acquire the present plant that an entirely new one be constructed by the city.

Perth Amboy, N. J.—Bids will be received until Aug. 30 by the Bd. Water Comrs. for furnishing and erecting an 8,000,000-gal. pumping engine, to be placed in the pump house at Runyon, N. J., as advertised in The Engineering Record.

Somerville, N. J.—The citizens are said to be considering the question of a new water supply from Watchung Mountains.

Goffs Falls, N. H.—It is reported that extensions are to be made to the water works. Chas. Walker, Supt.

Brooklyn, N. Y.—The following are the bids received Aug. 16 by John T. Oakley, Comr. Water Supply, Gas and Electricity, N. Y. City, for an engine house for high-pressure service at Furman and Joralemon Sts.: D. T. Ryan, 723 3rd Ave., $98,500; R. E. Hemingham, 4 Court Sq., $81,555; R. H. Deeves, 240 W. 132 St., $86,500; Geo. T. Driscoll, 391 Fulton St., $91,086; Thos. G. Carlin, 44 Court St., $88,634; Murphy Bros., 489 5th Ave., $91,474; C. H. Peckworth, 415 Hudson St., $85,275; Hahn & O'Reilly, 3311 3d Ave., $78,000; Behan & Cavanagh, 23d St. and 4th Ave., $85,346, and Church Constr. Co., 1 Madison Ave., $86,500.

Bids opened same time and place for an engine house for high-pressure fire service at Willoughby and St. Edwards Sts., were as follows: Murphy Bros., 489 5th Ave., $76,774; Fuller & O'Connor, 26 Court St., $71,723; Jas. MacArthur, 22 Ormond Pl., $79,500; Hahn & O'Reilly, 3311 3d ave., $64,000; C. H. Peckworth, 415 Hudson St., $73,290; Church Constr. Co., 1 Madison Ave., $75,500; Geo. T. Driscoll, 391 Fulton St., $75,000; Beleau & Cavanagh, 23rd St.and 4th Ave., $77,016; R. H. Deeves, 240 W. 132d st., $71,000; D. J. Ryan, 723 3rd Ave., $79,400, and T. G. Curlin, 44 Court St., $74,000.

Bids were opened same time and place for (*a*) 2 boilers and an (*b*) economizer at the new Gravesend Pumping Station: Ed. Burhorn, 71 Wall St., *a* $14,500, b $1,660; A. D. Gragner Co., 95 Liberty St., *a* $13,279, *b* $1,639; B. Franklin Hart, Jr. Co., 143 Liberty St., *a* $13,247, *b* $1,490, and United Heating Co., 174 Wooster St., *a* $9,300, b $2,400.

Bids were opened same time and place for a temporary pumping plant at the new Ridgewood Pumping Station: Borough Constr. So., 44 Court St., $37,589.30; R. J. F. Gerstle Co., 44th St. and 1st Ave., $39,537; S. K. Kellock, 44 Court St., $64,674.30, and T. Harris, 485 Flatbush Ave., $56,200.

Bids were opened same time and place for a pumping engine with all appliances complete at the new Gravesend Pumping Station: Camden Iron Works, Camden, N. J., $37,230; Allis Chalmers Co., Milwaukee, Wis., $27,495; Platt Iron Works, 93 Liberty St., $32,937; Marine Eng. & Machine Co., 80 Bway., $26,900, and Snow Steam Pump Works, 114 Liberty St., $23,900.

R. J. F. Gerstle Co., 44th St. and 1st Ave., bid for furnishing 4 water tube boilers at the new Ridgewood Pumping Station (bids opened same time and place), $269.87.

Fillmore, N. Y.—The Fillmore Water Co. has been incorporated with a capital of $10,000. Directors: Chas. Ricker, A. H. Lyman and W. S. Mills, all of Fillmore.

Ft. Plain, N. Y.—Bonds to the amount of $15,000 are about to be sold to be used for the proposed water works improvements. Engineer, F. K. Baxter, of Utica.

**Oneida, N. Y.*—Contracts have been awarded for constructing the concrete dam and the impounding reservoir to T. S. Allen & Co., of Oneida, as follows (bids received Aug. 8): Concrete dam, $17,914; an 18-in. pipe line to connect the old and new reservoirs, $7,691, and grubbing, clearing and fencing reservoir site, $4,224.

Only one other bid was received for constructing the concrete dam, that of Finch, Anderson & Co., of Glens Falls, at $21,582.

Southern Pines, N. C.—Bids will be received Sept. 13 for constructing a water works and sewerage system, to cost $10,000. Address the Mayor.

Dickinson, N. D.—The citizens have voted in favor of municipal ownership of water works, the first bond issue to be for $23,000.

Enderlin, N. D.—Bids are to be received until Aug. 24 for constructing a water system here. T. R. Atkinson, Engr., Fargo, N. D.

Bellaire, O.—It is reported that the Bd. Pub. Service will soon ask bids for the construction of a filtration plant, the Council having authorized the expenditure of $35,000 for the plant. Chapin & Knowles, Engrs., Canton, O.

**Cincinnati, O.*—The contract to lay water mains in Eggleston Ave. and 9th St., it is stated, has been awarded to Keeling & Ridge Co., at $44,742.

Thos. Maloney, it is stated, submitted the lowest bid for laying water mains in Ludlow, Dodsworth and Hamilton Aves., at $10,452.

Newburg, O.—It is reported that the question of issuing $50,000 water improvement bonds is under consideration.

Plymouth, O.—See "Power Plants, Gas and Electricity."

Portland, Ore.—It is stated that 9 miles of water mains are to be laid by the City Water Wks. in order that residents of Mt. Tabor, East Irvington, Highland, Woodlawn,

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**Items marked thus give the names of parties awarded contracts.*

Piedmont, Peninsular and University Park may have a greater supply of water. It is reported that the cost of the work will be about $150,000.

Shelby, O.—The installation of a plant for the purification of the public water supply is under consideration by the Shelby Water Co.

Struthers, O.—It is reported that the Mahoning Valley Water Co. has increased its capital from $10,000 to $199,000, and proposes constructing cisterns and reservoirs at Struthers.

Toledo, O.—See "Schools."

Springfield, Ore.—The question of installing a water system at a cost of $12,000 is reported under consideration.

Mountain Park, Okla. Ter.—The Otter Creek Irrigation Co. (Judge W. H. Hankins, of Quanah, Pres.) is contemplating the irrigation of about 20,000 acres of land in Kiowa County. The site on which it is proposed constructing the dam is on Otter Creek, about 3 miles north of Mountain Park. The dam is to be 70 ft. high and 300 ft. long.

**Ashland, Pa.*—The following are the bids received Aug. 1 and opened Aug. 11 for additions to the water distributing system, the details on some of the items being given: (a) P. Frank Hawman, Reading, $18,505; (*b*) DeNallo & Klingberry, Kingston, N. Y., $16,552 (awarded contract); P. J. Cleary, Shenandoah, Pa., $17,166. Engineer's estimate $16,736. (T. Chalkley Hatton, Engr., Wilmington, Del.):

	a	*b*	*c*
2,550 ft. 12-ft. heavy wr. c.-i. pipe...	$2.134	$2.05	$2.08
1,440 ft. 12-ft. medium wr. c.-i. pipe..	1.881	1.75	1.85
1,170 ft. 10-ft. medium wr. c.-i. pipe..	1.628	1.50	1.50
850 ft. 8-ft. medium wr. c.-i. pipe..	1.364	1.48	1.40
530 ft. 8-ft. heavy wr. c.-i. pipe..	1.744	1.40	1.28
280 ft. 6-ft. heavy wr. c.-i. pipe..	1.166	1.25	1.12
330 ft. 6-ft. medium wr. c.-i. pipe..	1.166	1.02	1.20
1,560 ft. 4-ft. old c.-i. pipe removed.	0.165	0.13	0.40
170 ft. 6-ft. old c.-i. pipe removed.	0.275	0.16	0.45
150 ft. 6-ft. old c.-i. pipe relaid..	0.583	0.50	0.55

Philadelphia, Pa.—State Health Comr. Dixon, of Harrisburg, has appointed Dr. Seneca Egbert, of Philadelphia, to inspect the water supplies in the vicinity of Philadelphia.

Philadelphia, Pa.—Bids will be received until Sept. 6 by A. Lincoln Acker, Dir. Pub. Wks., for filtering materials and collectors for the Torresdale filters, as advertised in The Engineering Record.

Shamokin, Pa.—Wm. H. Dechant, of Reading, is the engineer in charge of the contemplated improvements which are to be made by the Roaring Creek Water Co., of Shamokin (C. Q. M. Williams, Pres.).

Woodville, Pa.—Bids will be received until Aug. 23 by by the Bd. Dirs. (W. H. Guy, Chmn.) of the Allegheny County Home, for constructing an intake crib, suction well and basket strainer for said home.

Columbia, S. C.—Local press reports state that 41 proposals were received on various portions of the work of constructing the new water works (bids opened Aug. 8); also four bids on the whole contract. The lowest complete bid was that of Geo. O. Tenny, of Spartanburg, for $153,694. The other three complete bids were from McMaster, Guignard & Co., of Columbia, $171,664; Neely & Kelley, Spartanburg, $178,240, and Guild & Co., Chattanooga, Tenn., $184,000.

Sanford, S. C.—Additions are to be made to the water works system and will require 3,000 ft. of 8-in. and 7,000 ft. of 4-in. water mains, valves and 50 hydrants, the cost to be between $6,000 and $8,000. A. L. Neill, Chmn. Water Com.

Gregory, S. D.—It is reported that steps are being taken toward the securing of a system of water works.

Bolivar, Tenn.—See "Power Plants, Gas and Electricity."

Nashville, Tenn.—The question of extending the water works is reported to be under consideration.

Johnson City, Tenn.—The City Council has passed on first reading the ordinance granting a 25-year franchise to the Johnson City Water Co.

Ft. Worth, Tex.—The present supply of the water system, which is 3,000,000 gals. per day, is to be doubled by the sinking of additional wells.

Paris, Tex.—Hugh M. Price, City Engr., writes that no bids were received on Aug. 7 for furnishing material and constructing a new intake pipe line, which will probably cost $1,600. He further states that if satisfactory bid is received, contract will be let, otherwise the city will do the work.

Poultney, Vt.—Among the improvements contemplated to the water works is the putting in of an auxiliary pumping station, and a gasoline engine, and the laying of about 1,400 ft. of 7-in. c. i. pipe. A. G. M. Johnson, Supt.

Richmond, Va.—Bids will be received until Sept. 5 by Chas. E. Bolling, Supt. Water Wks., for constructing a steel reinforced concrete conduit about 1 mile long and 5 ft. internal diameter and pipe connections with same; furnishing 36 or 42 in. c. i. pipe, about 1 mile long and connections therewith, specials and valves; laying and calking 36 or 42-in. pipe, and for all trenching, refilling and rip-rapping pertaining to this work, about 1 mile long.

Tacoma, Wash.—The Mount Tacoma Water Supply Co. (P. C. Kauffman, Pres.) it is stated, has made a proposition to the city to build a high dam and reservoir about 22 miles from Tacoma, and pipe the water to the city. Estimated cost, $1,500,000.

La Crosse, Wis.—About 3 miles of water mains are to be laid at a cost of $20,000. Date of receiving bids for said work not yet decided upon. Frank Powell, City Engr.

Murray, Utah.—The City Council is considering the question of a water system at a probable cost of $20,000.

Salt Lake City, Utah.—Jas. H. Anderson, Mgr. Anderson-Callister Investment Co., 308 State St., writes that bids will be received until Aug. 31 for improvements to the plant of the Salt Lake County Water Co., to cost $20,000.

Banff, Alta.—It is stated that bids will be received until Aug. 31 by the Dept. of the Interior, Ottawa (Perley G. Keyes, Secy.) for constructing water works and sewers for this town; John Galt, Engr., 29 King St. E., Toronto, Ont.

Edmonton, Alta.—Bids will be received until Aug. 22 by the Comr. Pub. Wks. (G. J. Kinnard, Secy.-Treas.) for an additional pumping engine. For further information apply to J. H. Hargreaves, City Engr.

Victoria, B. C.—It is stated that bids will be received until Sept. 18 by Wm. Northcott, Purchasing Agent, for supplying 1,000 ft. 2-in. and 12,000 ft. 4-in. c. i. water pipe.

**Regina, N. W. Ter.*—Dobson, Jackson & Fry, it is stated, have received the contract to lay 11,400 ft. of water mains and the same amount of sewer extensions at about $23,400.

St. Marys, Ont.—See "Power Plants, Gas and Electricity."

SEWERAGE AND SEWAGE DISPOSAL.

Notes Arranged Alphabetically by States.

Jonesboro, Ark.—Theo. Hartman, of Little Rock, it is stated, is making a preliminary survey for the proposed sewerage system.

Gilroy, Cal.—See "Power Plants, Gas and Electricity."

Durango, Colo.—Plans are being prepared for sanitary sewers for this city. W. H. Wigglesworth, City Engr.; Hiram Phillips, 615 Frisco Bldg., St. Louis, Mo., is consulting engr.

Lake City, Fla.—Wm. W. Lyon, of Palatka, has been selected by the Bd. of Bond Trus. to prepare plans and supervise the construction of a sanitary sewerage system, to cost $30,000.

St. Augustine, Fla.—John M. G. Carrera, City Clk., writes that no action has been taken as yet, but it is proposed to bond the city for $100,000 for the construction of a sewerage system.

Chicago, Ill.—Bids will be received until Aug. 31 by the Dept. Pub. Wks. (J. M. Patterson, Comr.) for furnishing materials and constructing approximately 1,220 ft. 5½ ft. sewer in a portion of 63d St., including 8 manholes; also reconstructing 7 catch basins and 56 house drains.

Edwardsville, Ill.—It is reported that this city will soon let contracts for sewer work and brick paving, to cost in all about $60,000.

Doquoin, Ill.—See "Water."

Rochelle, Ill.—The Iowa Engineering Co., of Clinton, Ia., has completed plans for a sewerage system to be constructed here.

Downer's Grove, Ill.—It is stated that bids will be received until Aug. 22 by the Bd. Local Improv., for constructing a system of storm water drains; W. S. Shields, Engr., 1715 Marquette Bldg., Chicago.

East St. Louis, Ill.—It is reported that the Bd. Pub. Affairs has had plans prepared for an outlet sewer system.

Le Roy, Ill.—The construction of a sewerage system is reported under consideration.

South Bend, Ind.—Resolutions have been adopted by the Bd. Pub. Wks. authorizing the constructing of pipe sewers in E. Wayne, Allen and Oak Sts. and Vassar, Blaine and Sherman Aves.

**Bartleysville, Ind. Ter.*—The citizens have voted in favor of extending the sewerage system for which Chas. F. Derr has the contract. Wm. H. Whaler, Engr. in charge.

Hammond, Ind.—It is stated that bids will be received until Aug. 25 by the Bd. Pub. Wks. for constructing main sewers; W. F. Bridge, City Engr.

Riverside, Ind.—The Bd. of Trus. have ordered the construction of a main sewer and branches. The main sewer is to run the full length of Reserve St. to the river, and the branches to be in the alleys east and west from Main St. The main sewer is to be of tile commencing at 8 and increasing to 10, 12 and 15-in. The branches are to be 8-in. Total cost estimated at $5,000.

Davenport, Ia.—See "Water."

Cedar Rapids, Ia.—The City Council has authorized the construction of a sanitary sewer in Iowa and Walnut Sts., requiring about 5,300 lin. ft.

Indianola, Ia.—The City officials are considering the construction of a sewerage system at a cost of $60,000.

Opelousas, La.—The citizens are considering the question of a sewerage system.

Northampton, Mass.—The Sewer Comrs. are considering the extending of the sewerage system in the direction of North River from Meadow St. and Meadow Road. The sewer is to be of brick and will require 552 ft. 66-in., 540 ft. 60-in. and 175 ft. 54-in. sewer, and it is estimated that the cost will be about $12,000. The city may do the work itself.

Marion, Mass.—An election is to be held on Aug. 25 to vote on the question of constructing a system of sewers and a sewage disposal plant. Williams & Whitman, of New York, N. Y., are the engrs.

Lowell Mass.—The City Council has under consideration the $50,000 loan for the construction of sewers. Geo. Bowers, City Engr.

River Rouge, Mich.—The Council is said to be considering the installing of a pumping system in connection with the sewerage system at a cost of $150,000.

Crystal Falls, Mich.—E. E. Bradbury, of Columbus, O., is the engineer who will have charge of the construction of the sewerage sytem to be installed here. Robt. Munns, City Clk.

**Grand Rapids, Mich.*—The National Constr. Co., of South Bend, Ind., it is stated, has received the contract to construct the trunk sewer along the line of the big ditch (bids opened Aug. 11), the material to be used not yet decided upon. The National Constr. Co. submitted 2 bids, one on Parmalee patent cement reinforced blocks at $102,338, and the other on solid concrete construction at $104,878.

Winona, Minn.—Bids will be received until Aug. 28 for constructing a storm water sewer, requiring 700 ft. 28-in., 700 ft. 24-in., 350 ft. 15-in., and 350 ft. 18-in. pipe, with catch basins and manholes. J. P. Coleman, City Engr.

Albert Lea, Minn.—The Sewer Com. of Council is considering the building of a main sewer from Spring Lake through the Gilbert House hill to Shell Rock River. Estimated cost about $20,000.

Appleton, Minn.—It is stated that the city is considering the installing of a complete system of sewerage.

St. Paul, Minn.—City Engr. Rundlett estimates the total cost of constructing a sewer in portions of Aldine, Dayton, Pierce, Marshall and Snelling Sts., at $13,584.

Columbia, Mo.—See "Power Plants, Gas and Electricity."

Havre, Mont.—It is stated that septic tanks will probably be built at Havre, as State Bd. of Health objects to sewage being discharged untreated into the Milk River.

**Anaconda, Mont.*—Thos. Kelly, it is stated, has secured the contract to construct the sewer to drain the eastern addition at $7,500. About 7,000 ft. of 15-in. pipe will be required.

Trenton, N. J.—Bids will be received until Aug. 24 by the Common Council for constructing a sewer in portions of Monmouth St. and Clinton Ave. Harry B. Salter, City Clk.

Cape May, N. J.—An ordinance has been filed with the City Clk. authorizing the issue of $72,000 bonds for the laying of sewers on Beach Ave. from Madison Ave. N. to Baltimore Ave., in the new portion of Cape May.

New Brunswick, N. J.—It is stated that bids will be received until Aug. 28 by Saml. G. Farrell, Street Comr., for constructing a sewer.

New York, N. Y.—Bids will be received until Aug. 28 by John F. Ahearn, Boro. Pres., for furnishing materials and constructing sewers and appurtenances in portions of W. 140th, 170th, 171st and 177th Sts. Engineer's estimate: 2,263 lin. ft. 15 and 12-in. salt-glazed vitr. stoneware pipe sewer; 193 lin. ft. brick sewer 3 ft. 6 in. x 2 ft. 4 in.; 3,811 cu. yds. rock to be excavated and removed; 41,000 ft. B. M. of timber and planking for bracing and sheet piling; 6,700 ft. B. M. of timber and planking for foundation, etc. Boro. Manhattan.

Chatham, N. Y.—The Village Trus. have appointed Pres. E. M. Wilcox a committee of one to ascertain the probable cost and other preliminary facts in connection with the installation of a sewerage system. A disposal plant will be necessary.

Lestershire, N. Y.—The citizens have voted in favor of constructing sewers.

**Utica, N. Y.*—F. C. Willbrand, of Northampton, Mass., it is stated, has received the contract to furnish 12,000 bbls. of Northampton Portland cement for the intercepting sewer in Utica, for which Besch & Beebe have the contract.

Troy, N. Y.—It is stated that bids were received from John H. Gleason at $3,900 and M. H. Cavanaugh, at $3,400 for constructing the sewer in Stow Ave.

Dunkirk, N. Y.—The City Council has decided to install a complete sewerage system in the 1st and 4th Wards, according to plans prepared by City Engineer Morrissey, the cost to be about $50,000.

**Scotia, N. Y.*—Jas. A. Hoyt, Jr., Village Clk., writes that Hinman & Sproul have received the contract to construct the sewage disposal plant at about $20,000.

Southern Pines, N. C.—See "Water."

Port Clinton, O.—It is stated that bids will be received until Aug. 28 by W. H. Cleaver, Village Clk., for constructing a branch sewer in Sewer Dist. No. 9.

Willoughby, O.—It is stated that bids will be received by C. C. Jenkins, Village Clk., until Sept. 11 for constructing a storm sewer in Erie St. Approximate quantities: 3,275 lin. ft. 24, 18, 15 and 12-in. sewer pipe; 9 manholes, 16 catch basins, etc.

Cleveland, O.—Bids will be received Aug. 29 by the Bd. Pub. Service (A. R. Callow, Secy.) for constructing sewers in portions of Bway, Harvard and Seager Sts.

Cincinnati, O.—An ordinance has been adopted by the City Council authorizing the Bd. Pub. Service to construct sewers and drains in Bloody or Rose Run from the end of the present sewer to Mill Creek, at an estimated cost of $224,000.

City Engineer Breen has submitted to the Bd. Pub. Service a resolution and specifications for a sewer in Forrest Ave. from Reading Road to Rosedale Ave., in Bogart Ave., from Forrest to Glenwood Ave., and in Glenwood Ave. from Reading Road to Washington Ave., the estimated cost is $17,623.

Canton, O.—The construction of 600 ft. of 8-in. sanitary sewer in Anton St., and 800 ft. of 8-in. sanitary sewer in Center St., and the paving with block about 3,000 ft. on Tuscarawas St., is under consideration by the Council. C. A. Zellers, Clk. Bd. Pub. Service.

A resolution has been adopted by the Council authorizing the sewering of Schniers Run, which will consist of about 2 miles of storm sewer of either brick or concrete. No plans have been prepared as yet. The improving of 12 other streets is contemplated this year. F. E. Myers, City Engr.

**Items marked thus give the names of parties awarded contracts.*

West Chester, Pa.—The Council is reported to be considering the installing of a filtration plant in connection with the sewerage system.

Titusville, Pa.—The Sewer Com. has reported to the Council in favor of a 24-in. tile sewer in Martin St.

York, Pa.—The Highway Com. of the Boro. of North York has been authorized to ascertain the cost of constructing a sewerage system.

Williamsport, Pa.—The City contemplates constructing a sewer about 4,000 ft. long and averaging 5 ft. in diameter. Jas. F. Fisher, City Engr.

Bloomsburg, Pa.—The Town Council has decided to construct a 24-in. sewer in 5th St. from the river to the canal, according to plans prepared by Jas. C. Brown, Town Engr.

Harrisburg, Pa.—Engineers Chas. Mebus, of Philadelphia, L. E. Chapin, of Pittsburg, and Robt. S. Raithbun, of Allentown, it is stated, have been appointed by State Health Comr. Dixon to make inspections of proposed extensions to sewer systems in different parts of Pennsylvania. This work will eventually be done by a regular corps of sanitary engineers appointed by Comr. Dixon, who will make a thorough inspection of the sewer systems before granting permits.

*Hollidaysburg, Pa.—Robt. W. Smith, Boro. Secy., writes that the Vipond Constr. Co., of Altoona, has secured the contract for constructing a flood sewer on Juniata St. and lateral sewers on several other streets, at an estimated cost of $12,000.

Central Falls, R. I.—An appropriation of $17,600 has been made for constructing sewers and improvements on Adams Ave., Illinois St. and Lonsdale Ave.

Lake Preston, S. D.—D. C. Washburn, of Aberdeen, has plans and surveys completed for the proposed sewer system which is to be constructed here at a cost of about $10,000.

Roanoke, Va.—It is reported that bids will be received until Sept. 1 for constructing a sewerage system. J. H. Wingate, City Engr.

Elkins, W. Va.—It is reported that arrangements are being made for the construction of a sewerage system from Main St. to the Tygart River.

Watertown, Wis.—It is stated that bids will be received by the Bd. Pub. Wks., until Aug. 29 for constructing about 7,000 lin. ft. sanitary sewers; E. B. Parsons, City Engr.

Merrill, Wis.—F. E. Mathews, City Engr., writes that no provision has been made for readvertising the work of constructing sewers in portions of Cottage, W. 4th and State Sts., and that probably none will be made this year.

*Kaukauna, Wis.—Jas. Sullivan, of Appleton, it is stated, has secured the contract to construct sewers in 2d, 6th and Whitney Sts., at a total cost of $3,350.

Regina, N. W. Ter.—See "Water."

Banff, Alta.—See "Water."

Malakoff, Ont.—Bids will be received until Aug. 26 by Jas. Meredith, at Malakoff, for $5,112 drainage bonds for the township of Marlborough.

BRIDGES.

Notes Arranged Alphabetically by States.

Bridgeport, Conn.—E. T. Buckingham, City Clk., writes that the following are the bids opened on Aug. 10 for the construction of a reinforced concrete arch bridge over Ash Creek, between Bridgeport and Fairfield: (*a*) Standish Stone Corp., Bridgeport; (*b*) Tucker & Vinton, N. Y. City, N. Y.; (*c*) Bell Eng. & Const. Co., N. Y. City, N. Y.; (*d*) Abbot-Gamble Co., N. Y. City, N. Y.; (*e*) Russell Constr. Co., N. Y. City, N. Y.; (*f*) J. E. Fitzgerald Co., New London, Conn.; (*g*) Bunting Constr. Co., N. Y. City, N. Y.; (*h*) Crouse Constr. Co., Perth Amboy, N. J.; (*i*) John Franzelli, South Norwalk, Conn.; (*j*) F. Wardwell, Stamford, Conn.; (*k*) Miller Collins Co., N. Y. City, N. Y; (*e*) Frank Pidgeon, Saugerties, N. Y.; (*m*) Jeremiah Finch, Glens Falls, N. Y.; (*n*) Middlesex Constr. Co., New Brunswick, N. J.

	Earth fill. per cu. yd.	Rip rap per cu. yd.	Material removed, per cu. yd.	Railing, per lin. ft.	Macadam roadway, per sq. yd.	Totals.
a	$.70	$2.00	$.65	$.25	$.65	$12,000
b	.82½	2.00	1.25	.50	2.00	23,000
c	.60	1.00	.35	.40	.90	29,768
d	.50	1.00	1.00	.50	.65	15,800
e	.87	2.50	.75	.25	.74	11,475
f	.65	2.10	2.00	.30	1.00	14,617
g	.67	1.50	.35	1.00	1.25	10,325
h	.83	1.50	1.00	.40	.73	12,748
i	.78	2.35	1.50	.43	.60	11,600
j	.75	2.25	1.00	.50	.65	11,500
k	.79½	1.05	.70	.50	.80	14,492
l	.80	2.00	2.00	3.00	2.00	34,550
m	.66½	1.75	.66½	.18	.65	14,419
n	.48	2.25	.35	.25	.60	12,442

Chicago, Ill.—See "Paving and Roadmaking."

East St. Louis, Ill.—It is reported that the East St. Louis & Suburban Ry. Co. (W. A. Bennett, Engr. M. of W., E. St. Louis) will soon let the contract for 2 viaducts, one to be in East St. Louis over the Louisville & Nashville R. R. on N. 7th St., and cost about $20,000; the other at French Village, over the Louisville & Nashville and the St. Louis & O'Fallon R. R. It will be 1,000 ft. long, of concrete and steel and estimated to cost $35,000.

Springfield, Ill.—Bids will be received until Sept 4 by the Park Bd. (Arthur Hay, Secy.-Engr.) for constructing 2 reinforced concrete bridges on pile foundations in Washington Park.

Chicago, Ill.—Bids will be received until Aug. 23 by the Dept. Pub. Wks. (J. M. Patterson, Comr.) for furnishing materials and constructing a temporary bridge over the west fork of the south branch of the Chicago River, near S. Western Ave.

Peoria, Ill.—The City Council has decided to receive competitive plans for a low-level bridge across Illinois River at Bridge St., to be 40 ft. wide, 6 ft. sidewalks, with either a bascule, trunnion or lift span. Total length of bridge to be 11,000 ft. and to be of either steel or reinforced concrete. C. M. Dolan, City Engr.

*Wellesley, Mass.—M. McDonough, of Swampscott, Mass., has secured the contract to construct the Boylston St. Bridge for the Metropolitan Park Comn. of Boston, at $25,464.

Gloucester, Mass.—The Comrs. of Essex County, at Lawrence, have accepted the plans of W. L. Webber, City Engr. of Gloucester, and The Scherzer Rolling Lift Bridge Co., of Chicago, Ill., for a rolling-lift bridge, 33 ft. roadway and two 6 ft. walks, with 2 leaves on stone abutments. A temporary pile and timber bridge is to be constructed and bids will be received until Aug 21 for building the temporary structure.

*Boston, Mass.—The following are the bids opened on Aug. 7 by the Metropolitan Park Comn. (John R. Rablin, Engr.) for building Boylston St. bridge and approaches and masonry dam at Charles River reservation, Newton and Wellesley: Atlas Reinforced Concrete Constr. Co., $34,947; Jones & Meehan, $32,266; T. H. Gill & Co., $31,154; Globe Constr. Co., $30,683; Patk. McGovern, $29,700; Woodbury & Leighton Co., $25,901; M. McDonough, Swampscott, $25,464 (awarded contract), and T. E. Ruggles, $22,880 (bidders of Boston unless otherwise mentioned). The detail bid of M. McDonough, the successful bidder, is as follows: 3,300 cu. yd. earth grading, 90 cts.; 330 cu. yd. rock grading, $4; 1,000 cu. yd. concrete masonry, $6.50; 500 cu. yd. stone masonry, $14; 1 reinforced concrete arch, 50-ft. span, $3,980; 1 plain concrete arch, 14-ft. span, $720; 305 lin. ft. stone coping (parapet), $1.80; 85 lin. ft. stone coping (dam), $2.20; 330 lin. ft. edge stone, $1.10; 12 cu. yd. brick masonry, $15; 110 lin. ft. 10-in. pipe drain, $1; 850 sq. yd. broken stone surfacing, 50 cts.; 600 sq. yd. gravel, 40 cts.; 300 cu. yd. loam, $1.50, and 550 sq. yd. walk, 40 cts.

*Clarksdale, Miss.—The Missouri Bridge & Iron Co., of St. Louis, Mo., has received the contract to construct a bridge across Sunflower River, near here (bids opened Aug. 7) at $9,900. W. H. Fitz-Gerald, Jr., Chancery Clk.

*Princeton, N. J.—The Bd. of Freeholders are stated to have awarded the contract for constructing a steel bridge over Stony Brook, at Alexander St., to N. A. K. Bugbee, at $7,379.

*Salem, N. J.—C. C. Ford, Jr., Clk. Bd. of Chosen Freeholders, writes that the contract for constructing a bridge across Alloways Creek from Salem to Harmersville (bids opened Aug. 9) has been awarded to New Jersey Bridge Co., of Manasquan, for $10,200.

Florence, N. J.—It is stated that bids will be received until Aug. 24 by the Bd. Chosen Freeholders, Mt. Holly, for erecting a bridge near Florence; Chas. E. Merritt, Co. Solicitor, 21 High St., Mt. Holly.

New York, N. Y.—Plans for the Manhattan terminal of the Williamsburg Bridge are reported to have been prepared by the Bridge Dept. and the contract for construction will be shortly awarded. The terminal will be entirely underground, to be 600 ft. long and about 180 ft. wide, covering an area of 120,000 sq. ft. The cost of constructing the terminal and making necessary alterations on the elevated tracks will amount to about $1,000,000.

*The Pennsylvania Steel Co., Steelton, Pa., has received the contract for the towers, cables, suspended superstructure and anchorages of the Manhattan Bridge (bids received Aug. 10) at about $7,284,000.

Brooklyn, N. Y.—Bids will be received until Aug. 24 by the Dept. Parks, New York City (John J. Pallas, Pres.) for furnishing materials, altering and repairing Terrace Bridge, Prospect Park, Boro. Brooklyn.

Zanesville, O.—Bids will be received until Aug. 29 by the Bd. Co. Comrs., for furnishing materials and paving the roadway, repairing and reconstructing the steel work of the first 490 ft. of the east approach to the 5th St. Bridge over the Muskingum River. L. E. Brelsford. Co. Aud.

Marietta, O.—Bids will be received until Aug. 24 by the Bd. Co. Comrs. for furnishing materials and constructing the substructure and superstructure for a steel bridge over Paw Paw Creek, Salem Township; C. C. Chamberlain, Co. Aud.

Woodward, Okla. Ter.—It is stated that bids are wanted until Aug. 28 for constructing 3 steel bridges near this place. They will be 180, 60 and 330 ft. long respectively. C. C. Hoag, Co. Clk.

Titusville, Pa.—Separate bids will be received until Aug. 21 by the Common Council for constructing 3 bridges of iron and concrete over Church Run; one at Union St., the second at Franklin St., and third at Walnut St.; W. W. Dame, City Clk.

*Marlin, Tex.—The Comrs. Court is stated to have awarded contracts for constructing 2 steel bridges over Brazos River as follows: Texas Bridge Co., for Smith's ferry bridge, $18,335; E. P. Alsbury & Son, of Houston, for Campbell's ferry bridge, $15,500, both structures to have 18 ft. roadway and main span 275 ft. long.

Aberdeen, Wash.—It is stated that a steel bridge will be constructed over Wishkah River, replacing present wooden structure; probable cost, $30,000.

Pasco, Wash.—It is stated that the Northern Pacific Ry. (E. J. Pearson, Ch. Engr., St. Paul, Minn.) will construct a steel bridge over Columbia River, at Pasco, at a probable cost of $500,000.

Milwaukee, Wis.—Bonds for the Grand Ave. viaduct, amounting to $450,000, are reported sold.

PAVING AND ROADMAKING.

Notes Arranged Alphabetically by States.

Hot Springs, Ark.—From $50,000 to $100,000 worth of paving will probably be done in this city in the immediate future. Sam'l Hamblen, City Engr.

San Francisco, Cal.—The City Engr. is stated to have estimated the cost of repaving a portion of Stevenson St. at $8,500.

The following bids are stated to have been opened for repairing and maintaining bituminous rock and asphalt pavements, *a* east of west lines of Van Ness Ave. and 11th St., *b* district west of the east line of Devisaders St. and north of southern line of Oak St.: Flinn & Treacy, *a* $21,000, *b* $3,950; The City Street Improv. Co., *a* $23,900, *b* $3,990; Union Concrete & Constr. Co., *b* $4,400, and J. J. Dowling, *b* $7,500.

Denver, Colo.—The Bd. of Pub. Wks. is stated to have opened on Aug. 1 bids for paving with sandstone paving blocks in Alley Dist. No. 1 as follows: Gibbons, Hughes & Cramer, $15,834; J. Fred Roberts, $17,320; Colorado Co., $17,618; R. A. Young, $18,468, and Denver & Pueblo Constr. Co., $18,481.

Hartland, Conn.—Bids will be received until Aug. 21 by the Bd. Selectmen (Geo. W. Miller, Chmn.) for grading and constructing 4 sections of road in this town.

*Washington, D. C.—The following are the bids opened Aug. 4 by Lieut. Col. Smith S. Leach, Corps Engrs., U. S. A., for (*a*) 10,000 sq. yds. macadam per sq. yd., (*b*) 6,000 ft. of cobble, per lin. ft., (*c*) excav. and trimming road bed per cu. yd.: Cranford Paving Co., Washington (awarded contract) *a* 83 cts., *b* 24¾ cts., *c* 27 cts. Brennan Constr. Co., Washington, *a* 97 cts., *b* 26 cts., *c* 50 cts. Thos. H. Lyons, Brookland, D. C., *a* $1.44, *b* 36 cts., *c* 60 cts.

New Castle, Del.—Bids will be received until Aug. 29 by Francis A. Price, Co. State Highway Comr., 1009½ Market St., Wilmington, Del., for macadamizing 12,770 ft. of the State Road.

*Tampa, Fla.—The contract for paving with vitrified brick about 16 miles of streets throughout Tampa (bids opened July 25) is stated to have been awarded to W. H. Kendrick, of Jacksonville, for about $600,000.

Alton, Ill.—The Bd. of Local Improv. has reported favorably the ordinance providing for the paving with brick of Alby, 8th, 3d, Market and Prosa Sts.; probable cost, $100,000.

Edwardsville, Ill.—See "Sewerage and Sewage Disposal."

Elgin, Ill.—Bids will be received until Aug. 25 by the Bd. Local Improv. for grading and paving with vitrified brick on a 5-in. concrete foundation on a portion of W. Chicago and S. State Sts., and for curbing, grading and paving with crushed gravel macadam on a part of S. State St., as advertised in The Engineering Record.

Chicago, Ill.—Bids will be received until Aug. 24 by Jos. M. Patterson, Comr. Pub. Wks., for furnishing material and paving with creosoted paving blocks the roadways of Randolph St. and Van Buren St. bridges, and the roadways over the machinery rooms on the approaches thereto, and the roadway over the machinery room on the north approach to the S. Halstead St. Bridge.

Chicago, Ill.—Bids will be received until Aug. 23 by the Bd. Local Improv. (And. M. Lynch, Pres.) for constructing cement sidewalks on portions of numerous streets.

*Chicago, Ill.—The contract for paving Vincennes Rd., 95th St., Leyden Ave., 111th St., 119th St. (bids opened July 27) has been awarded to Jas. A. Sackley Co., Chamber of Commerce Bldg., for $35,000.

Upper Alton, Ill.—It is stated that contracts will soon be let for about 2 miles of sidewalks.

*Corydon, Ind.—Frank E. Watson, Co. Aud., writes that the contract for constructing about 9 miles of gravel roads (bids opened Aug. 9) has been awarded to Chas. Calvert, of Scottsburg, for $34,990.

Terre Haute, Ind.—L. T. Perdue is stated to have submitted the lowest bid for graveling, constructing concrete sidewalks and curbing a portion of Spruce St., the bid being $10,449.

Keokuk, Ia.—The following bids are state to have been received Aug. 1 for paving with brick Blondeau St. (price given per sq. yd.): Henry Rees, of Quincy, $1.29½; Cameron & McManus, $1.47; McManus & Tucker, $1.34½.

*Ottumwa, Ia.—C. R. Allen, City Engr., writes that the contract for 3,000 sq. yds. brick paving on Washington St. (bids opened Aug. 7) has been awarded to Magden & Sheely, of Des Moines, for $5,500. The contract calls for Oskaloosa brick, one course, concrete foundation and cement curb.

Hutchinson, Kas.—An ordinance has passed the Council to pave 9 blocks with bitulithic and bids for the work will be asked in about 2 weeks. T. G. Elbury, City Engr.

Ottawa, Kan.—Bids will be received until Aug. 23 for grading, curbing, and guttering a portion of Cedar St., requiring 2,500 cu. yds. excavation and 5,400 lin. ft. combined curb and gutter. W. O. Myers, City Engr.

Louisville, Ky.—Press reports state that bids will be received by the Bd. Pub. Wks., until Aug. 28, for paving portions of Ormsby Ave., Slevin and 6th Sts., with vitr. brick; probable cost, $30,000.

*Shreveport, La.—The contract to lay 25,000 sq. yds. of bitulithic pavement in this city has been awarded to the Southern Bitulithic Co.

Cumberland, Md.—The City Council is stated to have passed ordinances providing for the paving with brick portions of Maryland Ave., S. Center, S. Liberty and 1st Sts.

**Items marked thus give the names of parties awarded contracts.*

Boston, Mass.—Contracts have been awarded as follows for building State Roads (bids opened Aug. 10): Swampscott, Wm. Shea & Son, Quincy, Mass., $2,430, and Concord, $8,305; Hadley, Lane Constr. Corporation, of Meriden, Conn., price $3,673, and Southampton, $3,866; North Adams, O. T. Benedict, Pittsfield, Mass., $3,762, and Colrain, D. T. Berry, Brattleboro, Vt., $2,780.

Detroit, Mich.—Bids will be received until Aug. 28 at the office of the Dept. of Parks and Boulevards (R. E. Bolger, Secy.) for constructing a macadam roadway on portions of the Boule. and Speedway.

The Dept. of Wks. is stated to have received bids for paving portions of streets as follows: Cleveland Trinidad Paving Co., of Cleveland, O., Chicago Boule. with asphalt, $9,367; Atkinson St., with asphalt, $4,978; Edison St., with asphalt, $5,343; Boston Boule., with asphalt $9,032; Michigan Contr. Co., of Detroit, Chicago Boule., with macadam, $7,333; Livingstone St., with cedar, $12,997; Boston Boule., with macadam, $7,738; Robt. Conway & Co., Sylvester St., with cedar, $5,593.

**Kalamazoo, Mich.*—Roy Williams, of Connersville, Ind., has secured the contract to pave with Metropolitan block on 6-in. Portland cement concrete foundation with Pioneer asphalt filler on W. Main St., requiring 11,000 sq. yds. at $1.82 per sq. yd. His bid for the street railway's portion was $1.92 per sq. yd. M. C. Taft, City Engr.

Duluth, Minn.—Petitions are nearly completed for paving 5 blocks on 10th Ave. E. with macadam or asphalt and 4 blocks on 5th Ave. W. with sandstone.

Hubbing, Minn.—It is stated that the city is contemplating the building of a tar macadam plant for use in paving work. W. B. Patton, of Duluth, is consulting Engr.

Shelbina, Mo.—It is reported that bids will be received by the Mississippi Valley & Gulf Ry. Co., until Sept. 10, for furnishing materials and constructing about 75,000 sq. ft. cement and granitoid walk.

St. Joseph, Mo.—The following bids are stated to have been opened on July 31 by the Bd. Pub. Wks. for paving with vitrified brick a portion of 11th St.: Phoenix Brick & Constr. Co., $1.39; Rackliffe & Gibson, $1.13½, and St. Joseph Street Constr. Co., $1.37 (price given per sq. yd.); probable cost of improvement, $35,000.

Omaha, Neb.—The City Council is stated to have passed the ordinance providing for the paving with brick a portion of Lake St.

**Concord N. H.*—The following contracts are stated to have been awarded (bids opened Aug. 10) for constructing portions of state highways: Lane Constr. Co., of Meriden, Conn., for road in Pembroke, at 74 cts.; Wiel Gordon, of Franklin Falls, for macadamized road in Bristol, 99 cts.; Osgood Constr. Co., of Nashua, for road in Amherst, 57 cts.; Soule Dillingham & Co. of Boston, for road in Hollis, for a total of $1,147 (price given per lin. ft.).

**Wilmington, N. C.*—A. M. Waddell, Mayor, writes that the contract for furnishing 20,000 tons crushed stone (bids opened July 25) has been awarded to C. H. Dock, city quarry, Wilmington, $1.30 per ton. The city leases a quarry and contracts for the delivery of the stone.

Bids will be received by the Co. Comrs. (D. McEachern, Chmn.) until Aug. 30 for $50,000 road improvement bonds.

Elizabeth, N. J.—Bids will be received until Sept. 1 for paving Mary St. bet. Jefferson and Madison Ave., 1,000 sq. yds. asphalt on a depressed block foundation. W. H. Luster, Jr., City Surveyor.

**Irvington, N. J.*—The Warren Bros. Co., of Boston, Mass., have received the contract for 11,700 sq. yds. of bitulithic pavement in this city.

**Newark, N. J.*—The following contracts are stated to have been awarded for paving (*a*) New Jersey Paving Cor., (*b*) J. Roosevelt Shanley, (*c*) Wm. Van Reuren, Lackawanna Ave., *a*, with brick, $11,022; Summit St., between Brientsnall Pl. and Morris Canal with granite block, $2,909; Summit St. between Morris Canal and Sussex Ave. with brick, *c*, $13,906; Third Ave. with brick, *c*, $2,624; Broome St. with brick, *a*, $13,152, and Fairview Ave. with brick, *b*, $9,448.

*The Standard Bitulithic Co. is stated to have received the contract for resurfacing a portion of Milford Ave. for $7,080.

New York, N. Y.—The following are the bids opened on Aug. 10 by the Comrs. of Parks for furnishing and delivering 5,000 cu. yd. coarse North River road gravel for drives in Central and Riverside Parks (price given per cu. yd.): H. Miller, $1.82, and John B. Rose Co., $1.84.

The Local Improv. Bd. is stated to have decided to improve 7th Ave. from 110th St. to Harlem River by laying a 10-ft. parkway with a drive on both sides 35 ft. wide; probable cost of improvement, $125,000.

Brooklyn, N. Y.—Bids will be received until Aug. 24 by the Dept. Parks, New York City (John J. Pallas, Pres.) for regulating, grading, paving or repaving, with asphalt, a portion of Pitkin Ave., Boro. Brooklyn.

Long Island City, L. I., N. Y.—Bids will be received until Aug. 28 by Jos. Cassidy, Pres. Boro. Queens, for regulating, grading, curbing and laying sidewalks and cross walks on portions of several streets. Engineer's estimate: 39,000 cu. yds. earth excav.; 15,600 lin. ft. concrete curb; 77,000 sq. ft. cement sidewalk and 8,250 sq. ft. new bluestone bridging; also for regulating, grading and repaving with macadam the roadway of Strong's causeway from Flushing Creek to North Hempstead. Engineer's estimate, 8,900 sq. yds. macadam.

Albany, N. Y.—It is stated that all bids received for resurfacing S. Pine Ave. have been rejected and, according to reports, new bids will be received.

The following bids are stated to have been received for paving with brick a portion of B'way: Albany Material & Constr. Co., $2.20; E. F. Dillon, $1.86; M. F. Dollard, $1.90, and Mulderry Bros, $2.10 (price given per sq. yd.).

It is reported that bids will soon be received for resurfacing and improving portions of streets as follows: Delaware Ave. with asphalt, brick paving on Clinton Ave., Quail St., North Lake Ave., Colby, Thornton and Bossett Sts.

**Rochester, N. Y.*—The following bids are reported opened on Aug. 2 by the Bd. of Contract for paving: Geo. W. Hagaman, Ritz St. with brick, $4,078, Harrison St. with brick, $9,083 (awarded contract); Rochester Vulcanite Paving Co., Ritz St. with asphalt, $3,918; Brayer & Albaugh, Burke St. with brick, $3,000, with macadam, $2,500.

**Troy, N. Y.*—The following bids are stated to have been received Aug. 1 by the Bd. Contract & Supply for paving with brick on a portion of Mill St.: John N. Gleason, $23,121 (awarded contract); T. N. Dumary, $23,510; F. M. Collins, $20,100, and Michael H. Kavanaugh, $23,975.

Troy, N. Y.—Bids will be received until Aug. 29 by the Bd. Contract and Supply (Jas. M. Riley, Clk.) for regulating, grading, curbing and paving a portion of N. 1st St.

Tuckahoe, N. Y.—Bids will be received by the Bd. Trus. until Aug. 21 for furnishing material, regulating, grading, curbing, and otherwise improving a portion of Washington Pl. Thos. J. McCarthy, Village Clk.

Canton, O.—See "Sewerage and Sewage Disposal."

Cincinnati, O.—Bids will be received until Sept. 6 by the Bd. Pub. Service (Geo. F. Holmes, Clk.) for furnishing materials and grading, curbing and paving with bowlders a portion of Sachem Ave.; also a portion of Fairfax Ave. with bitulithic.

Cincinnati, O.—Bids will be received until Sept. 15 by the Bd. Co. Comrs. for improving a portion of Foley's Road Eugene L. Lewis, Co. Aud.

Columbus Grove, O.—Press reports state that bids will be received until Aug. 29 by the Council for $12,300 paving improvement bonds.

Delaware, O.—The City Council is stated to have decided to issue $30,000 bonds for the paving of portions of Sandusky and Winter Sts.

Elyria, O.—Bids will be received until Aug. 21 by Frank R. Fauver, City Aud., for $23,650 bonds for improving Washington Ave., by grading, curbing and paving with sheet asphalt.

Zanesville O.—See "Bridges."

Marion, O.—All bids received Aug. 9 for furnishing material and paving with asphalt on a portion of Windsor St. have been rejected and new bids will be received Aug. 30. Wm. Fies, Clk. Bd. Pub. Service.

*The Barber Asphalt Paving Co., of Cleveland, has secured the contract to pave with Trinidad pitch lake sheet asphalt on Mt. Vernon Ave.

Bids will be received until Aug. 23 by the Bd. Pub. Service (Wm. Fies, Clk.) for grading, curbing and paving a portion of Church St., with Trinidad Pitch Lake sheet asphalt.

Portsmouth, O.—Bids will be received until Aug. 29 by the Bd. Pub. Service for paving 5 streets, estimated to cost a total of $54,246, as advertised in The Engineering Record.

**Hollidaysburg, Pa.* — Robt. W. Smith, Boro. Secy., writes that W. H. Herr & Sons, of Altoona, have secured the contract for paving Allegheny St. with brick, at an estimated cost of $18,000.

*Meadville, Pa.—John Swan, Jr., of Pittsburg, has received the contract to pave about 3,680 sq. yds. on Chestnut St., at about $9,000. H. L. Robinson, City Clk.

Oakmont, Pa.—The citizens are stated to have voted to issue $45,000 street improvement bonds.

Uniontown, Pa.—Bids will be received until Aug. 21 by Chas. F. Kefover, Boro. Solicitor, for furnishing f. o. b. cars Uniontown, about 232,000 vitr. paving brick; also for paving, excavating, ballasting, curbing, etc., a portion E. Fayette St.; contractor to furnish all the material except brick, which will be furnished by the city and hauled by contractor from cars at his own expense. Porter & Hogg, Boro. Engrs.

Chattanooga, Tenn.—Bids will be received until Aug. 22 by the Bd. Pub. Wks. (A. L. Thomas, Chmn.) for constructing chert, macadam and gravel roadways, with the required brick gutters and curb resetting, on portions of 8 streets; also a portion of William St., without brick gutters.

**Dallas, Tex.*—The bitulithic pavement has been adopted by the city and a contract for 12,000 sq. yds. has been awarded to the Southern Bitulithic Co.

Sherman, Tex.—The City Council is stated to have authorized the City Clerk to receive bids for paving Crockett and Travis Sts., about 2¼ miles of pavement; probable cost of improvement $75,000. According to reports bids will be received on brick and concrete.

Salt Lake City, Utah.—The City Council is stated to have adopted resolution authorizing the Bd. Pub. Wks. to receive bids for paving a portion of S. Temple St.

**Auburn, N. Y.*—Brayer Bros., of Auburn, have secured the contract for paving Clark St. (bids opened Aug. 7) at a total of $33,769 for bitulithic pavement, using Auburn curb. and Mack block. Bids were submitted on asphalt and on bitulithic or bituminous macadam as follows: (*a*). M. C. McGreevy, (*b*) Mayor Bros., (*c*) Brayer Bros. (awarded contract), (d) Barber Asphalt Paving Co. (J. Walter Ackerman, City Engr.):

	a	*b*	**c*	*d*
11,600 sq. yds. asphalt paving	....	$1.87½	$1.98	$1.94
11,600 sq. yds. bitulithic or bituminous macadam	....	....	2.12	1.95
280 sq. yds. brick (Mack block)	$2.14	2.40	2.50	2.44
280 sq. yds. brick (Mertopolitan block)	....	....	2.50	....
6,400 lin. ft. Auburn Grey Line Curb set	....	.82½	.76	.95
6,400 lin. ft. Medina Curb set	.80	.80	.75	.90
730 lin. ft. protection curb set	.65	.40	.45	.60
19 catchbasins connected with sewer	52.00	50.00	45.00	75.00
15,000 sq. ft. sidewalk relaid	.04	.06	.03	.03
240 lin. ft. 12-in. surface water sewer	.65	.70	1.00	.75
11,600 sq. yds. extra for excav. delivered by contractor; property of city	.40	.80	.15	.25

**Tacoma, Wash.*—Geo. M. Savage & Co., California Bldg., has secured the contract to construct cement sidewalks in Dist. 244 at $13,360.

Green Bay, Wis.—W. W. Reed, City Engr., writes that the following are the bids opened on Aug. 7 for 27,378 sq. yds. granite top macadam on Webster Ave. and Porlier St., including 14,800 lin. ft. cement curb and gutter: La Crosse Stone Co., La Crosse, $30,833; J. K. Delany, Green Bay, $36,064; James Forrestal, St. Paul, Minn., $38,042; John O. Jones, Racine, $34,600, and Jno. Stiffier, Marinette, $36,150.

Janesville, Wis.—Bids will be recevied until Sept. 11 by the Street Assessment Com. for paving a portion of Milwaukee Ave. with macadam requiring about 3,704 sq. yds. paving and 1,884 lin. ft. cement curb and gutter. C. V. Kerch, City Engr.

**Milwaukee, Wis.*—The Badger Constr. Co., 105 Grand Ave., is stated to have secured the contract for paving with brick a portion of Mitchell St., at $1.68 per sq. yd.

POWER PLANTS. GAS AND ELECTRICITY.

Notes Arranged Alphabetically by States.

Citronelle, Ala.—H. A. Healy, Comr. Electric Light, writes that the town desires a promoter to furnish electric lighting to the town.

Opelika, Ala.—It is reported that the capacity of the Opelika electric plant is to be increased three fold to furnish power for the road, and light and power to Opelika and Auburn. Capital $300,000. It is stated that work of construction is to be commenced within 30 days.

Dardanelle, Ark.—It is reported that bonds have been sold by the city for an electric light plant and the building of the plant is to be started immediately.

Gilroy, Cal.—The citizens have voted in favor of issuing $51,000 bonds for the purpose of constructing sewers, providing water and electric lights and completing the City Hall.

Marysville, Cal.—The Marysville & Nevada Power & Water Co., it is reported, is having surveys made under the direction of Engr. Waggoner for a canal system that will irrigate many thousands of acres of land in Yuba County. At the point where the survey crosses Dry Creek, it is stated, that provision is being made for the installation of an electric light plant.

Lakeland, Fla.—The Council has under consideration the question of increasing the capacity of the electric light plant, also putting same on duplicate basis figuring on two 150-hp. compound engine, a 100-kw. generator and a 150-hp. boiler. W. B. Clay, Supt. Electric Light plant.

La Grange, Ga.—Bids will be received until Sept. 5th by the Electric Light Comn. for all machinery and construction work and building for a complete electric light plant, as advertised in The Engineering Record.

Edwardsville Ill.—The City Council has granted a franchise to the Slocum & Siegel Gas Co. for erecting, maintaining and operating of a gas, refrigerating and electric plant for the purpose of furnishing power, light and heat.

Lockport, Ill.—Bids will be received until Oct. 11 by the Bd. Trus., Sanitary Dist., Chicago (S. D. Griffin, Clk.) for furnishing electrical apparatus and materials and for installing same in the power house of the Sanitary Dist. of Chicago, near Lockport, and transmission line along the right of way of said Dist. of Chicago. Bids may be submitted as a whole or separately on the following: Main switchboard and instruments; transfer boards, oil circuit-breaker switches and knife switches; remote controlled rheostats for generators; bus bars and bus bar and circuit compartments; conduits, service wiring, transformer and generator connections; transformers and lightning arresters; transmission line towers or poles; erecting towers or poles; copper and aluminum conductors; erection of cable; high tension insulators; electric traveling crane. Cost reported to be $160,000.

**Chicago, Ill.*—Jacob Rodaty has the contract for the enlarging of the Hyde Park plant of the Commonwealth Electric Co., the cost to be about $16,000. Shepley, Rutan & Coolidge, Archts., 84 Van Buren St.

Freeburg, Ill.—The Village Bd., it is reported, has decided to erect a $10,000 municipal lighting plant.

Loami, Ill.—The Sangamon County Light, Heating & Power Co., it is reported, has secured a 25-year franchise in this village. The village also contracted for five 2,000-c.-p. arc lights for 5 years.

Indianapolis, Ind.—The City Council has ratified the contract entered into between the Bd. Pub. Wks. and the Cleveland Street Lighting Co. for the gas and gasoline service.

Dana, Ind.—It is stated that the citizens have voted to install an electric light plant.

Peru, Ind.—Saml. Murdock, Pres. of the Gas Co., it is stated, is looking for a site on which to build a large gas generating plant.

Jasonville, Ind.—The Jasonville Electric Light Co. has employed a foreman, who will have charge of all the work in connection with the construction of their proposed electric light plant. Probable cost, $17,000. Frank F. Faucett, Engr. in charge, Bloomfield, Ind.; H. L. Hyatt, Secy. of company.

Albia, Ia.—The citizens on July 17 voted in favor of granting a franchise to Levi S. Davis of Bennington, Vt., for a gas plant.

Pikeville, Ky.—The Pikesville Electric Light Co. proposes installing a 100-kw., 250-volt generator, direct-connected to engine.

Algiers, La.—The Orleans Levee Bd. has granted permission to the New Orleans Railways Co. (A. L. Black, Electrical Engr., 317 Baronne St., New Orleans) to lay a number of cables across the river for the purpose of furnishing the necessary lights and electric wires to Algiers.

Arcadia, La.—A company has been organized here with a capital of $5,000 with J. L. Dalton as pres. and M. L. Tooke as secy. and treas. The company has bought the Dalton-Lord electric light plant located here, and it is reported will make considerable improvements and additions.

Ft. Fairfield, Me.—Survey is now being made for the proposed power plant of the New Brunswick Power Co. on Aroostock River. A. R. Gould, of Presque Isle, Me., is one of the parties interested.

**Items marked thus give the names of parties awarded contracts.*

Mason, Tex.—The Mason Electric Light Co. is now owned by W. Ellebracht, of Mason. It is proposed to install a 70-hp. engine to take the place of two engines now in use.

Ft. Fairfield, Me.—B. D. Whitney, of Ft. Fairfield, engr. of the Maine & New Brunswick Power Co., writes that survey is now being made for the proposed power plant of this company on Aroostook River. A. R. Gould, of Presque Isle, Me., is one of the parties interested.

Cumberland, Md.—The City Council has granted a franchise to the Atlantic Gas Co. for the laying of mains in Cumberland for natural gas, which the company proposes to pipe from the West Virginia fields.

Holyoke, Mass.—The Bd. of Aldermen on Aug. 11 passed the order authorizing the issuance of $75,000 bonds for the erection of a school in South Holyoke and the purchase of land therefor, and $30,000 bonds—$22,000 for enlarging and extending the gas works, etc., and $8,000 for reconstructing, enlarging and extending the electric light station.

Monroe, Mich.—The City Council, Aug. 10, passed a resolution for the sale of the municipal lighting plant to the General Constr. Co., Ltd., for $25,000, including a 10-year contract and franchise, lights at $56 per year. Both the sale and contract will have to be ratified by the people at a special election. Geo. T. Wolf, of Three Rivers, is one of the stockholders of the company.

Hart, Mich.—The Pere Marquette Power Light Co., it is stated, has been granted a 10-year franchise by the Council to furnish current to the village. The company will dam Ruby Creek, build a turbine plant and furnish light and power to Pentwater, Hart and Shelby.

Houston, Miss.—Bids will be received by J. M. Griffin, Town Clk., on Sept. 1, for the purchase of $13,500 water and light bonds, as advertised in The Engineering Record.

Kansas City, Mo.—The Kansas City Electric Light Co. (R. E. Richardson, Mgr.), it is reported, will place in new conduits.

Columbia, Mo.—John S. Bicknell, City Clk., writes that it was voted Aug. 8 to issue $10,000 water and electric light bonds and $10,000 public sewer bonds.

Auburn, Neb.—An ordinance has been introduced in the City Council granting to Wm. Lawler, of Lincoln, a 25-year franchise to construct and operate a water-works system and gas plant, the city to have the privilege of purchasing the same at the expiration of 10 years.

Winnemucca, Nev.—It is reported that the electric light plant has been damaged by fire.

Nutley, N. J.—The Town Council has granted a 4-year contract to the Public Service Corporation for the lighting of the streets of the town at $16 per lamp.

Woodstown, N. J.—The Woodstown Ice & Cold Storage Co., which lights this town, proposes installing a larger dynamo and engine. C. F. Moore, Mgr.

Newark, N. J.—Wm. J. Lansley, of Englishtown, engr. for the Manalapan Light Co., writes that cost of proposed work contemplated by this company is $40,000. The General Electric Co. furnishes the generators.

Roswell, N. M.—The Roswell Electric Light Co. has in contemplation an entire new equipment for the power house. J. H. Cook, Supt.

Silver City, N. M.—The City Council has granted a 50-year franchise to Geo. T. Schmelzel and assoc. for electric lighting purposes in this city. The franchise requires that work be commenced on the installation of the plant within 90 days and that the plant be in operation within 6 months.

Las Vegas, N. M.—The City Council has granted a 50-year franchise for street railways and electric lights to Wm. A. Buddecke, of St. Louis, Mo., owner of the present electric railway system. Extensions to the system to cost $15,000 have already begun.

Raton, N. M.—The Raton Electric Light & Power Co. (J. R. Smith, Supt.) proposes installing new boiler, engine and 150-kw. A. C. dynamo.

Brooklyn, N. Y.—Bids were opened Aug. 14 by C. B. J. Snyder, Supt. School Bldgs., N. Y. City, for installing electrical equipment in Erasmus Hall High School, Boro. Brooklyn, the bids received being as follows: Frank G. Blanchard, $28,000; Reis & O'Donovan, $22,233; A. Newburger Electric Co., $22,650; Peet, McAnerney & Powers, $21,880; T. Fredk. Jackson, $23,184, and W. M. Sheehan & Co., 136 Liberty St., N. Y. City, $20,800 (awarded contract).

*Bids were opened same time and place for installing electric equipment in School No. 87, Boro. Queens: T. Fredk. Jackson, $4,995, and Commercial Constr. Co., 1 Madison Ave., N. Y. City, at $4,537 (awarded contract).

Buffalo, N. Y.—It is reported that the control of the Niagara, Lockport & Ontario Power Co. has passed into the hands of a new syndicate of capitalists headed by John J. Albright, of Buffalo, and Mr. Westinghouse, of the Westinghouse Co., and it is stated that extensions are to be made.

Lestershire, N. Y.—The Village Bd. of Trus. has contracted with the Light, Heat & Power Co. of Binghamton for 5 years for the lighting of 30 lights and the main street.

Rockingham, N. C.—It is proposed to install new dynamo at the municipal electric light plant.

Plymouth, O.—All bids received Aug. 9 for furnishing material and equipment for an electric light and water plant have been rejected and new bids will be received Aug. 28. John T. Bulman is Clk. of the Bd. of Pub. Affairs.

Galion, O.—The Crawford County Gas & Electric Co. intends constructing a new power house at a cost of $40,000. S. N. Blake, 15 Westminster St., Providence, R. I., is the pres. of the company.

Toledo, O.—It is reported that the question of holding an election to vote on the issuing of $500,000 bonds for a city lighting plant is under consideration by the City Council.

Reading, O.—Engineer Geo. Hornung, of Cincinnati, has been engaged to design an entire new plant for Reading to take the place of the present electric light plant. New boilers, engines, generators, street lamps and line work will be required.

Plymouth, O.—All bids received Aug. 9 for furnishing material and equipping an electric light and water plant have been rejected and new bids will be received Aug. 28. John T. Bulman, Clk. Bd. Pub. Affairs.

Bellefontaine, O.—It is reported that $50,000 electric light bonds have been sold.

**Portland, Ore.*—Jas. Barrett, it is stated has secured the contract to build a stone power house 50 x 50 and 30 ft. high at the golf links for the Oregon Water Power Co. It is also stated that he has secured the contract to construct a dam and canal or tail race at Cazadero that will require 7,000 cu. yds. of stone. Both contracts are in connection with the power plant, which is being constructed on Clackamas River.

Springfield, Ore.—An Eastern syndicate which owns electric plants in Spokane, Walla Walla, Salem and other Oregon cities, has purchased, according to reports, through its agent, A. Welch, of Salem, the plant of the Lane County Electric Co., at Springfield, which furnishes light for that town and Eugene. The syndicate will take control of the plant in October. It is stated to be the intention of the company to increase the plant to 1,000 hp. and also that the construction of a system of electric railways in Williamette Valley is contemplated.

Tipton, Ore.—W. A. McNaughton, of Tipton, it is stated, is arranging for the construction of an electric power plant on Strawberry Creek.

Baker City, Ore.—It is reported that a corps of engineers has been engaged by the Baker Light & Power Co. to make surveys from power site on Rock Creek over the ridge into Bourne, and along Cracker Creek to the various mines using power.

Columbia, Pa.—The Lancaster County Electric Light & Power Co. (C. Edgar Titzel, Supt., Lancaster) is reported to have decided to construct a power station at Columbia.

Kutztown, Pa.—This borough is reported to have decided to issue bonds to the amount of about $8,000 for the construction and maintenance of an electric light plant.

Avondale, Pa.—It is stated that a company to engage in the manufacture of gas is arranging to establish a plant in Avondale to supply the towns in Southern Chester County. The use of the streets in Kennett, Toughkenamon, Avondale, and West Grove have been asked for by the promoters.

Philadelphia, Pa.—Articles of incorporation have been filed by the Wyoming Gas & Electric Co. with a capital of $150,000, to manufacture and operate gas and electric plants. Incorporators: John McPeak, Wm. F. Eidell and Frank R. Hansell.

The Philadelphia Electric Co., on Sept. 15, according to press reports, submitted the only bid to Director Potter for the electric lighting of the streets for the year 1906, at a total of $1,073,271.

McCall Ferry, Pa.—A mortgage of $10,000,000 has been filed in the Recorder's office at York to secure a bond issue for the McCall's Ferry Power Co., a corporation of New York capitalists, who propose building a power plant on the lower Susquehanna River near McCall Ferry. The Knickerbocker Trust Co., of New York City, is reported to be named as the trus. for the bondholders.

Anderson, S. C.—The Hatton Shoals Co. (R. S. Ligon, Pres.), it is stated, has been organized with a capital of $150,000, to develop 5,000 hp. on Tugaloo River, 16 miles east of Anderson. A. T. Smythe, of Charleston, is one of the directors.

**Bolivar, Tenn.*—The following are the contracts awarded for furnishing material for the water and light plant (bids received Aug. 10): Two 60 h.p. return tubular boilers, Southern Engine & Boiler Wks., Jackson, Tenn., $1,000, and 100 h.p. engine, at $1,247; heater and feed pump, to E. G. T. Colles & Co., Chicago, Ill., $186; electrical apparatus, Electric Supply Co., Memphis, Tenn., $2,266, and electrical supplies to Erving-Merkle Co., St. Louis, Mo., $755. Granbery Jackson, Nashville, Tenn., is the engineer.

Chattanooga, Tenn.—It is stated that plans have been submitted to the Secy. of War for approval for the lock and dam which is to be constructed by the Chattanooga & Tennessee River Power Co. across the Tennessee River near Hale's bar in connection with their electric power plant. It is reported that the company is contemplating the increasing of its capital from $3,000,000 to $4,500,000 so as to generate greater power, and also probably to furnish the towns of Decatur, New Decatur and Sheffield, Ala., with power. John Bogart, Consulting Engr., 16 Exchange Pl., N. Y. City, N. Y.

San Antonio, Tex.—The San Antonio Gas & Electric Co. proposes installing a 500-kw. A. C. generator.

It is reported that C. A. Zilker, of Bloomington, Ill., is promoting an organization with a capital of $500,000 to build an electric light plant.

Mason, Tex.—The Mason Electric Light Co. is now owned by W. Ellebracht, of Mason, and it is proposed installing a 70-hp. engine to take the place of 2 now in use.

Dallas, Tex.—The Dallas Electric Light & Power Co., it is reported, have taken out a permit to erect an electric light plant, the cost to be about $500,000.

Deseret, Utah.—An ordinance has been passed by the Council, according to reports, granting a 50-year franchise to the Utah Light & Ry. Co. (R. F. Hayward, El. Engr., Salt Lake City.)

St. Johnsbury, Vt.—The St. Johnsbury Electric Co. intends making improvements to its plant, but have closed all contracts for the improvements. E. E. Gage, Supt.

Radford, Va.—The Grayson Electrical Corporation, it is stated, will build a power house at Graysontown, 8 miles from Radford, to light the towns of Christiansburg, Childress and Riner, furnish power for a contemplated trolley line from Cambria to Christiansburg, besides such factories as may be established along the line. The company has a contract with the town of Christiansburg for the exclusive right to furnish light and power to the town for 30 years. Guy Grayson, Pres., and W. C. Grayson, Vice-Pres.

Blaine, Wash.—The Blaine General Electric Co., it is reported, has been incorporated with a capital of $50,000 for the purpose of supplying Blaine with light and power. It is to be run by the owners of the Monarch Mill.

Pullman, Wash.—Improvements are to be made to the city electric light plant. The entire line is to be rebuilt and electric pumping engine installed for city pumping, and a 75-h.p. motor, direct-connected to a centrifugal pump, 18 additional arc and 50 series incandescent street lamps, 25 to 40 commercial arcs and 1,500 commercial incandescent lights are to be installed, and other improvements made. The Washington State College is to be supplied with power. D. F. Staley, Mayor; H. V. Carpenter, Chmn. Electric Light Com.

Milwaukee, Wis.—It is stated that the Milwaukee Gaslight Co. contemplates constructing a brick and cement water-proof tunnel 8 ft. in diameter and 470 ft. long under the Milwaukee River at the foot of Jefferson St., to be used to carry the company's mains across the river.

Burlington, Wis.—At an election held Aug. 8, it is stated, the citizens voted to raise $12,000 for the establishment of a municipal electric light plant.

Princeton, Wis.—The citizens on Aug. 5th, it is reported, voted to issue $12,000 bonds to purchase the plant of the Citizens' Electric Light & Power Co.

Stoughton, Wis.—Bids will be received until Aug. 26 (readvertisement) for electrical apparatus and power equipment, the work to be let as follows: Power house, 150-hp. water tube boiler, 150-hp. steam turbine and generator, 100-kw. generator and 2 exciters, 2 switchboards, arc light transformers, 50 arc lamps, water wheel governor for two 100-hp. wheels; condenser, feed water heater and pump; old arc machine and switchboard for sale. John Holton, Chmn. El. Light Com. The previous item appeared in our issue of Aug. 5 as Stoughton, Ky., instead of Stoughton, Wis.

Florence, Wis.—The Pine River Improvement & Power Co. (E. W. Hopkins, Pres.) intends making improvements at a cost of about $50,000.

**Greenwood, Wis.*—The contract to construct an electric light plant (bids opened Aug. 4) has been awarded to W. D. Lovell, of Minneapolis, Minn., at $14,950. Elias Peterson, City Clk.

San Juan, Porto Rico.—Bids will be received until Dec. 2 by the Executive Council of Porto Rico for a franchise for the development of a certain water power known as Comerio Falls, situated on the La Plata River, approximately 17 miles in a direct line, from San Juan and at an elevation of about 85 meters above sea level, which falls are estimated to be able to develop about 1,000 hp. as a minimum and at times more, depending on local rains. Address Chief Clk. of the Council.

**Toronto, Ont.*—Among the improvements to be made by the Stark Telephone, Light & Power System, Ltd. (John Scott, Engr., "Langside," Summerhill Ave.) to its power plant stations, are the following: Reinforced concrete and earth dam, the installation of a pair of 36-in. turbine wheels, with extended shaft for connection to main line shafting in power house by rope gear. The rope shafting and gearing is to be supplied by the Dodge Mfg. Co., of Toronto, and the turbine wheels by Chas. Barber & Sons.

Victoria, B. C.—Bids will be received until Aug. 28 by M. Hutchison, City Electrician, for improvements to the electric light plant, the total cost to be about $11,000. Among the improvements contemplated is the changing of a part of the street lighting system to enclosed a.-c. arcs.

Westmount, Que.—Improvements are to be made here at a cost of $200,000, including the construction of an electric light plant. Ross & Holgate, of Montreal, Que., are the Engrs. in charge. A. D. Shibley, Asst. Secy.-Treas.

St. Marys, Ont.—The citizens are reported to have voted Aug. 7 to issue $15,000 bonds for the extension of the electric light plant and waterworks.

Brantford, Ont.—The Brantford Electric & Operating Co., Ltd., proposes installing a 500-hp. steam plant. Louis W. Pratt, Supt.

ELECTRIC RAILWAYS.

Notes Arranged Alphabetically by States.

Opelika, Ala.—It is announced that contracts have been let and preparations made for constructing an electric railway between this city and Auburn, for which 10 miles of track will have to be laid. The capacity of the Opelika electric plant will be increased threefold to furnish power for the road and light and power for Opelika and Auburn. The company is capitalized for $300,000. Work of construction is to begin within 30 days.

Harrison, Ark.—The Harrison Electric Light & Ice Co. will probably construct about 9 miles of electric railway and install 1,000 hp. steam equipment. R. M. Fellows, mgr.

Pyatt, Ark.—The Mineral Belt Traction Co. will start constructing proposed road about September, according to reports. The line will connect Pyatt, Dodd City, Kingdon Springs and Lead Hill, and will be operated by gasoline. It is expected ultimately to extend the line to White River and develop and use electric power; 27 miles of line will be built. A. J. Bradford, Pres.; E. W. Swart, Secy.; Neal Dodd, Treas.

Stockton, Cal.—Articles of incorporation of the Western Constr. Co. is reported to have been filed here. The object of the company is to build steam and electric railroads, and particularly to construct a new street railway system in Stockton. Capital, $250,000. Dirs.: H. H. Griffiths, Geo. A. Brown, Jr., J. C. Grider and others.

Oroville, Cal.—The Northern Electric Co. is reported incorporated to build and operate railroads. Capital, $3,000,000. Henry A. Butters, of San Francisco; Alpheus W. Clement, of Oakland, and others are reported interested.

Alton, Ill.—The Alton, Jacksonville & Peoria Traction Co. is stated to have secured the necessary franchises bebetween the cities mentioned and will begin construction work at once. J. E. Rhodes, Secy., Upper Alton.

Chicago, Ill.—Traction Expert A. B. Dupont, Aug. 11, submitted his report to Mayor Dunne, outlining the plans for the construction of 264 miles of independent street railway. The plans include the building of a power house, and will soon be submitted to the Com. on Local Transportation for final adoption.

Bloomington, Ind.—J. W. Brown, of Indianapolis, is stated to have applied to the Comrs. of Monroe County for a franchise for the Wabash & Southeastern Traction Co., which proposes to build from Terre Haute to Columbus by way of Bloomington.

**Items marked thus give the names of parties awarded contracts.*

Ft. Wayne, Ind.—It is reported that the Ft. Wayne, Bluffton & Marion Traction Co., will be extended from Bluffton via Hartford City, Montpelier and Anderson to Alexandria, the line to connect at Alexandria with the Union Traction Company's system for Indianapolis. The preliminary survey is to start at once.

Des Moines, Ia.—C. A. Park, who is promoting an electric railway between Des Moines and Creston, states that he has about completed plans for financing the road, and expects to be able to start construction work this fall. The proposed line will be 73 miles in length, and will pass through the towns of Commerce, McIntyre, Winterset, Macksburg and Creston.

The Interurban Ry. Co. is reported contemplating to abandon the construction of the proposed line between Woodward Junction and Perry, and to build north from Woodward to Boone.

Sioux City, Ia.—The Sioux City & Ireton R. R. Co. is stated to have organized with a capital fixed temporarily at $500,000. Sioux City will be headquarters. The articles state that the business of the company shall be the purchase, lease, construction, operation and equipment of railways in Iowa and other States. The immediate object is the construction of a line of railroad between Sioux City and Ireton, a distance of 38 miles, said line to be operated by steam, gasoline or electric motive power. It is the general opinion of those connected with the organization of the company that electricity will be used for power. The town of Ireton has granted the company a franchise to operate its lines over the streets of the city, and it is thought that suitable arrangements can be made with the Sioux City Traction Co. for entrance into Sioux City. Dirs.: Jas. Ahrens, D. Montgomery, M. A. Karr and others.

Louisville, Ky.—It is stated that a plan is proposed for constructing an interurban line to connect Louisville with a considerable portion of Southwestern Indiana. The proposed line extends from Corydon to Evansville, and traverses the counties of Harrison, Crawford, Perry, Spencer, Warwick and Vanderburg. D. W. Fairleigh, of Louisville; E. B. Lovell, of New York, N. Y., and W. P. Watson, of Kansas City, are reported interested.

**New Orleans, La.*—The Orleans Engineering Co. is reported to have awarded the contract to build and equip the electric railway running between Gretna and the naval station.

Benton Harbor, Mich.—The Michigan Terminal & Transfer Co. is reported to have asked the Council for a franchise to enter this city. The company will build a $40,000 bridge across the ship canal and continue north along the lake shore to South Haven and Saugatuck.

Jackson, Mich.—The West Michigan R. R. Co. contemplates constructing an electric railway, which will be a feeder for the Jackson & Battle Creek and the Detroit, Ypsilanti, Ann Arbor & Jackson Roads.

Manistique, Mich.—W. H. Needham, of Manistique, and others are reported to be promoting an electric railway from Manistique to Garden, a distance of 27 miles. The right of way is practically all secured, and a stock company will be organized at once.

Kansas City, Mo.—The Kansas City, Lees, Summit & Eastern Electric Co. is reported incorporated to construct an electric railway from Lone Jack to Kansas City. Cole Younger is reported interested.

Basin, Mont.—The Montana Northern Ry. Co. (C. C. Darrow, Secy. & Treas.) of Basin intends constructing an electric railroad of standard gauge from Basin, Mont., to Kalispell, a distance of about 240 miles, and making a connection and short cut between the lines of the Northern Pacific and the Great Northern Railways. Correspondence with the manufacturers of the supplies needed in this work is desired.

New York, N. Y.—The Rapid Transit Comn. is stated to have on Aug. 10 received from the secretary of the Bd. of Estimate a notice of the approval of maps and routes for the Manhattan and Brooklyn subways. The action permits the attorneys of the Comn. to get consents for building the various subways and authorizes the engineers to prepare the necessary contracts.

*Jas. P. McDonald, 42 B'way, it is reported, has secured the general contract for the graduation of masonry for as much of the line of the N. Y., Westchester & Boston Ry. Co. as lies within the city limits, in all about 4¼ miles. Cost reported to be $1,200,000. The work includes the leveling of the roadbed, grading streets, building buttresses and constructing bridges at all crossings. The work does not include laying of tracks. Geo. Tatnall, Principal Asst. Engr. of the company.

Las Vegas, N. M.—See "Power Plants, Gas and Electricity."

Niagara Falls, N. Y.—The Common Council is stated to have granted a franchise to the International Ry. Co. to construct and operate a street surface railway.

Hermon, N. Y.—The St. Lawrence Pyrites Co., of New York, is stated to have made a proposition to connect this village with DeKalb Junction, on the Rome, Watertown & Ogdensburg R. R., by trolley. Dr. F. W. Dalmage, W. G. Popple, George Babbitt, and others are reported to have been chosen to take up the matter with the company.

Ogdensburg, N. Y.—The construction of an extension to the Ogdensburg St. Ry. Co., to connect this city with Gouverneur by trolley, a distance of 30 miles is reported under consideration. An expenditure of $500,000 would be necessary for the improvement.

White Plains, N. Y.—The Bronx, White Plains & Yonkers R. R. Co., which is to build an electric railway on Central Ave., north of Yonkers Ave., is stated to have filed its bond for $20,000 with City Clerk Keeler, of Yonkers. The State Railroad Comrs. will give the public hearing on the above railway, in the Whitehall Building, at Battery Pl., New York, on Aug. 15.

Lorain, O.—Cleveland & Southwestern Traction Co. is reported to have in contemplation the construction of a belt line in Lorain.

Geneva, O.—Homer Hood, who owns a right of way from Geneva to the resorts on the lake front, is reported to be negotiating with the Cleveland, Painesville & Ashtabula Ry. Co. to build and operate the line.

Columbus, O.—The Columbus, Marion & Bucyrus Ry. Co. is reported incorporated, with $500,000 capital, by John G. Webb, O. M. Gottschall and others. The line will extend from Marion to Bucyrus, and will be an extension of the Columbus, Delaware & Marion. It will form a part of a direct route to both Toledo and Cleveland from Columbus. It is stated that the project has been financed and that work will be started this fall.

Oklahoma City, Okla. Ter.—The City Council is stated to have passed a franchise ordinance giving certain privileges to the Oklahoma City, Lexington & Sulphur Springs Electric Ry. Co. The ordinance provides that the railway is to be constructed between Oklahoma City and Capitol Hill. Geo. A. Teague, Secy. Contracts will be let in a few days, according to reports, for the construction of 40 miles of the line. Twenty miles will be constructed at the Oklahoma City end of the line and 20 miles at the Sulphur Springs end.

Springfield, Ore.—See "Power Plants, Gas and Electricity."

Portland, Ore.—Two hundred miles of standard-gauge electric railway in the form of a loop, with Portland as the starting point and terminus, is reported to be the project of Dr. Henry Waldo Coe, and his associates. The projected road starts from Portland, proceeds to Vancouver, crossing the Columbia River via Woodlawn, follows the north band of the Columbia to Ridgefield, Silver Lake and the St. Helens mining district. Power for the road is to be obtained from a plant which is to be located on the Toutle River, where engineers have estimated 35,000 hp can be generated from the fall of the river.

Royalton, Pa.—A charter is stated to have been granted to the Royalton & Elizabethtown St. Ry. Co. to construct one mile of line in Royalton. Wm. Trimble, of Philadelphia, Pres. Samuel L. Hibberd, Jr., L. G. Souder and others, directors.

Pittsburg, Pa.—A syndicate, headed by Murry A. Verner and Mayor Wm. B. Hays, is stated to have applied for charters for a subway system for Pittsburg. The sum of $10,000,000 will be involved in the deal, and work will be started as soon as the charters are granted. According to plans, the tunnel is to begin at Oliver Ave. and Smithfield St. and continue to Neville St., emerging below Luna Park, where the subway line will connect with surface lines in different streets, which are being made a part of the railway system. Mr. Verner has a franchise to operate cars in Oliver Ave.

Union City, Tenn.—A. E. Darrah is reported to have in contemplation the construction of an electric railway to connect Paducah Junction, Reelfoot Lake and Union City.

Seattle, Wash.—It is stated that the Seattle Electric Co. will file applications for franchises for the construction of new and the extension of two of its old lines, calling for a total expenditure of approximately $150,000. The application will be for a franchise for the construction of a double-track electric road on 2nd Ave., from Pike St. to Denny Way; the extension of the Broadway and Pike St. line ino the Denny-Fuhrman addition at Edgar St., and for the building of a cut-off on Fremont Ave., Fremont, along 43d Ave. to Phinney Ave., and thence to Woodland Park. This latter franchise is already pending before the Council.

Kenosha, Wis.—The Kenosha Electric Ry. Co. is reported to have announced that the construction of an electric railway west from Kenosha to connect with the lines of the Chicago & Milwaukee Electric Ry. Co. is contemplated.

RAILROADS.

Notes Arranged Alphabetically by States.

Birmingham, Ala.—It is stated that the Mobile & Ohio R. R. (T. L. Condron, Con. Engr., St. Louis, Mo.) will bulid a line into Birmingham within the next 12 months.

Denver, Colo.—It is stated that the Colorado & Southern R. R. (H. W. Cowan, Ch. Engr., Denver) is about to issue $15,000,000 refunding and extension bonds, the proceeds to be used to extend the road to the Gulf of Mexico.

Newnan, Ga.—Mike Powell, Chmn. of the Com. appointed to secure the rights of way for the Newnan & Greenville R. R., it is stated, has announced that nearly all the rights of way for the road have been secured.

Muncie, Ind.—The Chicago, Indiana & Eastern Ry. Co. (D. Anderson, Supt. Equipment, Matthews, Ind.) is having surveys made for an extension to be made between Muncie and New Castle Junction.

Purcell, Ind. Ter.—The Canadian Valley & Western Ry. Co. will receive bids until Sept. 1 for the construction of a line from Chickasha to Lehigh; probable cost of work, $2,600,000. Dorset Carter, Pres., and R. L. McWillie, Engr., both of Purcell, Ind. Ter.

Medicine Lodge, Kan.—A charter has been granted to the Denver, Kansas & Gulf R. R., with a capital of $2,000,000, for the purpose of constructing a railroad through the Kansas wheat belt. The headquarters of the company are to be in Medicine Lodge. Incorporators: Breckenridge Jones, St. Louis, Mo.; C. Q. Chandler, of Medicine Lodge, Kan.; Milton Brown, of Topeka, Kan., and others.

Morganfield, Ky.—The Missouri Constr. Co., of St. Charles, Mo., it is stated, submitted the lowest bid for grading the roadbed of the Morganfield & Atlanta R. R., at about $119,000.

**Albert Lea, Minn.*—It is stated that Tobey & Co., of Minneapolis, have secured the contract to grade the first 52 miles of the Duluth, Mankato, Glencoe & St. Cloud R. R. between Albert Lea and Mankato.

**Washwauk, Minn.*—Winston Bros. & Weidenhoff, it is stated, have received the contract to construct about 12 miles of the Albora-Bovey extension of the Duluth, Missabe & Northern R. R. into the village of Washwauk.

Corinth, Miss.—The Illinois Central R. R. Co. (A. S. Baldwin, Ch. Engr., Chicago, Ill.) it is stated, is contemplating the construction of a line between Corinth, Miss., and Birmingham, Ala.

Westpoint, Miss.—The citizens have voted in favor of issuing bonds necessary to secure the right of way and terminal grounds for the Pensacola & Western Alabama R. R.

Hoboken, N. J.—The plans of the Delaware, Lackawanna & Western R. R. (Lincoln Bush, Ch. Engr., Hoboken) for replacing its terminal in Hoboken recently destroyed by fire, provide for railroad and ferry structures with 16 tracks and 6 ferry slips, the buildings to be fireproof and constructed of concrete and steel throughout. The main waiting room will be 150 ft. square and 54 ft. high. The exterior of the station will be 600 ft. long on the river side, with a central tower 225 ft. high.

Montclair, N. J.—The Bd. of Freeholders has adopted a resolution appropriating $15,000 toward the cost of the abolition of the grade crossing at Blomfield Ave., Montclair, on the Delaware, Lackawanna & Western R. R. The entire cost of the improvements is to be $60,000.

New York, N. Y.—See "Electric Railways."

New York, N. Y.—The N. Y. Central & Hudson River R. R. (C. J. Parker, Prin. Asst. Engr.) is reported to be contemplating the abolition of 56 grade crossings on its road between New York City and Crotona and New York City and White Plains on the 2 divisions of the railroad. It is proposed that the R. R. pay one-half the cost, the State to pay one-quarter and the municipalities one-quarter.

**Cleveland, O.*—Wm. Bros. & Morse, of Cleveland, it is reported, have received the contract for the elimination of the first of the 5 groups of grade crossings in Cleveland on the Cleveland & Pittsburg Division of the Pennsylvania R. R., which is known as Group No. 5. The work includes the excavating of about 194,000 cu. yds. dirt and about 10,000 cu. yds. of masonry work.

**Kingwood, O.*—H. Renneck, it is stated, has secured the contract to construct 10 miles of the Morgantown & Kingwood R. R. from Kingwood to Trowbridge. The contract for the stone work for the bridges across Green Run and Cheat River has been secured, according to reports, by Weaver & Zevely, of Morgantown.

Pittsburg, Pa.—The Point Pleasant R. R. Co. has been incorporated with a capital of $12,000, for the purpose of constructing a railroad from the Wabash Pittsburg Terminal R. R. to the coal fields along Cross Creek, in Cross Creek Township, Washington County. Incorporators: Dr. S. L. McCullough, of Carnegie, Pres.; O. R. Cooke, Carnegie, Treas., and Geo. M. Hosack. The J. C. Barr Co., 6417 Kentucky Ave., Pittsburg, is in charge of the engineering work of the road.

Dawson, Tex.—Ch. Engr. Chas. L. Henning, of the El Paso & Southwestern R. R., is making a survey for a line from Dawson to a point near Santa Rosa, Cal., the road to pass through Las Vegas, N. M.

**Mexia, Tex.*—Johnson Bros. it is stated, have received the contract to build the Brazos Valley extension from Mexia to Houston, a distance of about 180 miles.

Stockdale, Tex.—Bids will be received until Aug. 26 by W. G. Van Vleck, 2d Vice-Pres. and Mgr., Galveston, Harrisburg & San Antonio Ry. Co., at Houston, for the graduation and track laying of about 47 miles of the extension of said road, from Stockdale to Cuero.

Weatherford, Tex.—Engr. F. M. Jones, of Las Vegas, N. M., has completed a survey, according to reports, from Weatherford, Tex., to Texico, and the Santa Fe R. R. Co. is now securing the right of way for the road.

Wytheville, Va.—The South & Western R. R. (H. Hardaway, Supt., Georgel, Va.), which now runs between Johnson City, Tenn., and Spruce Pine, N. C., it is stated, is to be extended for nearly 285 miles into the Clinchfield coal properties in Wythe and Dickinson Counties, Va. Engineers are now making surveys and estimates of the costs of the work. Alfred Walters, formerly Pres. of the Lehigh Valley R. R., according to reports, is to be made president of a holding corporation which is to provide funds for the enterprise, and is later to be made president of the road. W. M. Ritter, of the W. M. Ritter Lumber Co., Harrison Bldg., Columbus, O., is said to be interested in the project.

Kennewick, Wash.—It is reported that a branch line of the Northern Pacific R. R. (E. J. Pearson, Ch. Engr., St. Paul, Minn.) is to be built between Kennewick up the Columbia River into Yakima Valley.

**Kaukauna, Wis.*—M. C. Connors, of Kaukauna, it is reported, has secured 500,000 yds. of track grading work to be done for the Chicago, Burlington & Quincy R. R. He is reported to have sublet all the steam shovel excavating to Phalen & Shirley, of Omaha, Neb., and has about 85,000 yds. of team work to let.

**Salt Lake City, Utah.*—The Wm. Kennefick Constr. Co., of Kansas City, Mo., it is reported, has received the contract to build the Western Pacific Ry. from Salt Lake City, Utah, to San Francisco, Cal., the cost to be $11,000,000.

**Winnipeg, Man.*—The double-tracking of the Canadian Pacific R. R. between Winnipeg and Ft. William, it is stated, will cost about $10,000,000. The contract for grading and rock cutting, it is reported, has been awarded to Foley Bros., Larson & Co., of St. Paul, Minn., at about $3,000,000.

Mexico.—E. J. Chamberlin, Gen. Mgr. of the Canada-Atlantic Ry., it is stated, is about to resign and become president of the Morelia & Tacrambaro Ry. Co., which has been formed to construct a railway in the Highlands of Mexico. The road is to be about 250 miles long. G. E. Fanquier, of Ottawa, Ont., Can., is associated, according to reports, with E. J. Chamberlain.

Lima, South America.—A. W. McCune, of Peru, it is reported, has plans under way for the construction of a railroad from Lima to Cerro De Pasco mining dist., a distance of 110 miles, to cost $7,000,000. He is also said to be planning a branch line of railroads to connect the mining districts with the nearest navigable branch of the Amazon River, to be about 175 miles long and cost about $15,000,000.

PUBLIC BUILDINGS.

Notes Arranged Alphabetically by States.

Whipple Barracks, Ariz.—Bids will be received until Sept. 8 (Capt. Chas. C. Walcutt, Q. M., Prescott) for the construction, plumbing, hot-water heating and electric wiring of hospital at Whipple Barracks, as advertised in The Engineering Record.

Sonoma, Cal.—City Hall bonds amounting to $10,000, it is reported, have been sold.

San Francisco, Cal.—Bliss & Faville, Crocker Bldg., are preparing plans for the Clara Barton Hospital, which is to be erected in this city and is to be a 7-story and basement structure, to cost $250,000.

Bids will be received until Sept. 11 by Col. Wm. S. Patten, Asst. Q. M. Genl., U. S. A., for construction

**Items marked thus give the names of parties awarded contracts.*

and electric wiring of frame additions to 16 sets barrack buildings at the Presido of Monterey.

*Thos. Butler, of San Francisco, has received the contract for erecting the U. S. Custom House at San Francisco (bids opened July 20, by the Superv. Archt., Washington, D. C.) at $1,119,300.

Gilroy, Cal.—See "Power Plants, Gas and Electricity."

Brighton, Colo.—The Comrs. of Adams County intend erecting a brick and stone court house to cost $40,000.

Denver, Colo.—It is stated that the Jewish Sanitarium will be enlarged at a cost of $50,000. W. S. Friedman is reported interested.

**Washington, D. C.*—The contract for erecting an addition to the marine barracks, to include band room, mess hall, gymnasium, guard room, prison and amusement room is stated to have been awarded to Chas. McCaul Co., of Philadelphia, Pa., for $91,126 (bids opened July 20 at the office of Quartermaster of U. S. Marine Corps).

Pensacola, Fla.—It is reported that an election will be held soon to decide on erecting a police court and jail, at a cost of $75,000.

Chicago, Ill.—It is stated that the County Bd. has decided to reject all bids recently received for removing the old courthouse and will probably ask new bids.

It is stated that a laundry building will be erected at 41st and Parrish Sts. for the Women's Hospital, to cost $28,000.

Richard E. Schmidt, 172 Washington St., is stated to have plans for the police station to be erected at Harrison and La Salle St., appropriation available, $150,000.

**Louisville, Ky.*—Robt. W. Brown, Secy. Free Public Library Bd., writes that the contract for erecting the library (bids opened Aug. 9) has been awarded to John Pierce, of Chicago, Ill., for $225,128.

**Latonia, Ky.*—Kyle & McDermutt, of Covington, have received the contract to erect the brick and stone county infirmary (bids opened Aug. 7) at $106,000. G. W. Jameson, Chmn. Com., Covington.

**Frankfort, Ky.*—The following bids are stated to have been opened Aug. 1 by the State Com. for erecting the State Capitol Bldg. with (*a*) Bedford stone, (*b*) Bowling Green stone: General Supply and Constr. Co., of New York, N. Y., *a* $880,000 (awarded contract), *b* $983,695; John Gill & Sons, Cleveland, O., *a* $884,142; J. E. Gibson, Anderson, Ind., *a* $897,058, *b* $942,258; H. W. Schluter, Chicago, *a* $902,438, *b* $1,032,438; Noel Constr. Co., Baltimore, *a* $904,432, *b* $972,233; H. Probst, New York, *a* $910,461; J. W. Foltz & Co., Cincinnati, O., *a* $955,292, *b* $1,084,250; Caldwell & Drake, Columbus, Ind., *a* $968,888, *b* $993,850; John Pierce, New York, N. Y., *a* $1,017,700; John T. Wilson, Richmond, Va., *a* $1,019,000, *b* $1,148,000; Miles & Brandt Co., Atlanta, Ga., *a* $1,055,000, *b* $1,035,000; Hennessey Bros.' Co., Chicago, Ill., *a* $1,096,983, *b* $1,231,983; Thos. Reilly, Philadelphia, Pa., *a* $1,096,940, *b* $1,146,923; L. B. Beerman, Chicago, *b* $1,441,000.

Baltimore, Md.—The following are the bids received Aug. 14 by the Superv. Archt., Washington, D. C., for interior finish, etc., for the U. S. Custom House, at Baltimore, Md.: Henry Smith & Sons Co., Baltimore, $295,610; D. W. & G. H. Thomas, Baltimore, $347,000; W. P. Lyscomb, Washington, D. C., $353,969; Cramp & Co., Philadelphia, Pa., $314,250; J. A. McGonigle, Leavenworth, Kan., $368,800; A. B. Stannard, New York, N. Y., $297,200.

Bids will be received until Sept. 13 by the Bd. of Awards (C. Clay Timanus, Pres.), for the foundation work for the Produce Market, which is to be erected on the lot bounded by Centre, Market, Space, Lombard and Water Sts. and W. Falls Ave.; also separate bids for the superstructure of said building. Bids will also be received at the same time for erecting the superstructure of the Fish Market, which is to be erected on the east side of Centre Market Space, south of Baltimore St.

South Haven, Mich.—W. W. Holmes, Secy. Library Bd., writes that the contract for erecting a library (bids opened Aug. 1) has been awarded to J. L. Simmons, 2162-2164 W. Madison St., Chicago, Ill., for $10,684.

Grand Rapids, Mich.—Bids will be received until Aug. 26 by Col. Geo. H. Turner, Commandt. Soldiers' Home, for erecting a hospital on the grounds of the Michigan Soldiers' Home; Osgood & Osgood, Archts., Widdicomb Bldg.

**Adrian, Mich.*—The contract to erect the U. S. Post Office at Adrian, bids for which were opened by the Superv. Archt., Washington, D. C., on Aug. 7, has been awarded to E. W. Ried & Co., of Flint, Mich., at $29,983.

St. Paul, Minn.—Plans are stated to have been completed for a concrete pavilion to be erected at Como Park, at a cost of $40,000.

Plans are stated to have been approved by the Bd. Trustees for the 3-story building for the Soldiers' Home; probable cost of structure $50,000.

**Moorehead, Minn.*—W. H. Merritt, of Moorehead, it is stated, has secured the contract to erect the Carnegie Library at $10,622.

Bolivar, Mo.—The citizens of Polk County are stated to have voted to issue $50,000 bonds for erecting a court house.

Kansas City, Mo.—It is proposed to erect 2 fire stations, each to cost $16,000, one at 2500 E. 16th St., the other at 3031 Holmes St.

**Jefferson City, Mo.*—Hill O'Meara Constr. Co., of St. Louis, is stated to have received the contract for erecting the Supreme Court building at an altered bid of $176,000. The structure to be of pressed brick and Ste. Genevieve stone.

**Savannah, Mo.*—The County Court is stated to have awarded the contract for erecting the jail and sheriff's residence to J. H. Sparks, of Kansas City, for $16,400.

New York, N. Y.—Bids will be received until Aug. 23 by John F. Ahearn, Boro. Pres., for repairing the public court and rooms belonging to same, also vestibule and lobby, etc., in Jefferson Market; also plumbing work in the police court of said building; bids will also be received same date for repairing courthouse, 153 E. 57th St.; also for plumbing work in said building, all in Boro. Manhattan.

Buffalo, N. Y.—Plans have been filed for an addition to the Providence Retreat at Main St. and Humboldt Parkway. The extension to be 4 and 5-story brick and terra cotta structure, to cost $180,018. Esenwein & Johnson, Archts., Ellicott Sq.

**Rome, N. Y.*—The Bd. Mgrs. of the Rome State Custodial Asylum (Chas. Bernstein, M. D., Supt.) on Aug. 7th awarded the contracts for constructing a 3-story ward building to Whalen & Son, of Ogdensburg, at $72,524; heating and plumbing to Breen Bros., of Utica, at $5,848 and $6,560 respectively, and electric wiring and fixtures to Commercial Constr. Co., of New York, N. Y., at $2,257.

Saratoga, N. Y.—It is stated that 2 bids were received Aug. 11 by the State Bd. of Armory Comrs., at Albany, for the reconstructing and enlarging the State Armory at Saratoga, they being from the Hudson Valley Constr. Co., of Troy, at $31,440, and from Thos. Whalen & Son, of Ogdensburg, at $47,000.

Ellis Island, N. Y. Harbor, N. Y.—Bids will be received until Aug. 30 by Robt. Watchorn, Comr. of Immigration, for erecting an extension to present hospital building at Ellis Island.

**Fargo, N. D.*—Lauritzen Bros., of Fergus Falls, Minn., has secured the contract to erect the U. S. Post-Office at Fargo (bids opened by the Superv. Archt., Washington, D. C., July 24) at $54,990.

Bismarck, N. D.—Bids, including plans and specifications, will be received until Sept. 19 by the Bd. State Capitol Comrs. (T. R. Shaw, Secy.) for remodeling and reconstructing the Capitol Building.

Canton, O.—It is stated that $20,000 has been donated toward the erection of a hospital.

**Cleveland, O.*—Contracts for building the branch library on Crawford Rd., near Hough Ave., were let by the Library Bd. as follows: For excavating, mason work and concrete floors, $13,800, to W. T. Paul & Son; for roofing and metal work, $1,193, to Rudolph & Son Co.; for heating, $1,802, to John Thompson, and for plumbing, $1,177, to Dewstoe & Brainard.

Akron, O.—Bids will be received Sept. 20. (readvertisement) for erecting a court house. L. H. Oviatt, Chmn. Co. Comrs.; J. Milton Dyer, Archt., Dayton, O.

Philadelphia, Pa.—It is stated that Field & Medary, 1414 S. Penn Sq., will soon receive bids for a branch Carnegie Library to be erected at 17th and Spring Garden Sts. The plans provide for a 1-story brick structure trimmed with terra cotta.

McKeesport, Pa.—The following are the bids received Aug. 16 by the Supervising Archt., Washington, D. C., for erecting the U. S. Post-Office at McKeesport, Pa.: Mankin Constr. Co., Richmond, Va., $81,557; J. G. Nukefer & Co., Chillicothe, O., $74,845; King Lumber Co., Charlottesville, $82,476; Wm. Weber, Huntington, $65,000; Constable Bros., Erie, Pa., $87,970; Fissell & Wagner, New York, N. Y., $69,800; Richardson & Burgess, Washington, D. C., $73,912; A. & S. Wilson Co., Pittsburg, Pa., $96,780; Jno. Grant & Son, Cleveland, O., $87,949; Thos. Reilly, Philadelphia, Pa., $77,831; F. L. Stevenson Contract Co., Dallas, Tex., $72,900; Harris & Adams Co., Pittsburg, Pa., $88,190.

**Spartanburg, S. C.*—The contract to erect the U. S. Post-Office at Spartanburg (bids opened by the Superv. Archt., Washington, D. C., on July 26) has been awarded to Mankin Constr. Co., of Richmond, Va., at $43,239.

Terrell, Tex.—Bids will be received until Aug. 28 by the Bd. Mgrs. (John L. Terrell, Pres.) for erecting 1 female annex, 100x170 ft.; 1 male annex, 80x170 ft., and 1 addition to old building, 40x136 ft., all 3-story brick buildings, at the North Texas Hospital for the Insane. C. A. Gill & Sons, archts., Dallas.

Stephenville, Tex.—Bids, including plans and specifications, will be received until Aug. 28 by the Co. Court Comrs., for erecting a jail, including installation of cages, cost not to exceed $28,000. M. J. Thompson, Co. Judge.

Burlington, Vt.—Bids will be received until Aug. 31 by Jas. Knox Taylor, Superv. Archt., Treasury Dept., Washington, D. C., for the low-pressure steam heating apparatus, complete in place, for the U. S. Post Office and Custom House at Burlington.

Lynchburg, Va.—It is stated that Mrs. Thos. F. Ryan will soon let the contract for erecting a 3-story fireproof hospital at 10th and Clay Sts., to cost about $100,000.

**Norfolk, Va.*—The Kellogg-Howell-McCrum Co., it is stated, has secured the contract for the heating, piping and sanitary equipment for the Jamestown Exposition, to be held at Norfolk at about $400,000.

Bremerton, Wash.—The following bids are stated to have been opened by the Navy Dept., Aug. 5, for erecting the extension to the joiner shop for Construction and Repair Dept., at Puget Sound Navy Yard: Congress Constr. Co., Chicago, Ill., $20,500; T. Ryan, of Seattle, $17,900; J. H. Randall, of Seattle, $19,320, and the Puget Sound Bridge & Dredging Co., $21,950.

Seattle, Wash.—The plans of Kerr & Rogers, Hancock Bldg., are stated to have been approved for the armory to be erected in Seattle; probable cost of structure, $100,000.

La Crosse, Wis.—Bids will be received until Sept. 1 by Comr. of Fisheries. Dept. of Commerce and Labor, Washington, D. C., for constructing a building for retaining fish and storing apparatus at La Crosse.

**Chippewa Falls, Wis.*—The Bd. of Control, it is stated, has awarded the contract to erect the dormitory at the Home for Feeble-Minded at Chippewa Falls to Geo. R. Potter, of Stevens Point, at $32,675.

Appleton, Wis.—It is stated that all bids received for the Carnegie Library, to be erected here, have been rejected, being in excess of the $50,000 appropriation. According to reports new bids will be received for a pressed brick building.

Winnipeg, Man.—Bids will be received until Aug. 22 by Ald. Chris. Campbell, Chmn., Special Com., for erecting a new police station and civic offices on the Market Square.

**Guelph, Ont.*—Booth & Hagarty, of Brockville, are stated to have received the contract for erecting an armory at Guelph, for about $125,000.

St. John, N. B.—Extensive plans for the improvement of the system of lighthouses along the Atlantic seaboard of Canada are announced by J. F. Fraser, of the Canadian Marine Dept., of Ottawa. Within a few weeks an improved light will be placed on Gaunet Rock, in the Bay of Fundy. A powerful light will be established on Cape Race. Lights also will be erected at Cape Ray, Cape Bauld and Cape Norman, Newfoundland; Greenly Island, in the Straits of Belle Isle; Heath Point, Anticosti Island; Fame Point, Cape Magdalen; Martin River, Quebec; Gyron Island, Gulf of St. Lawrence; Manger's Beach, at Halifax, Sea Island, Nova Scotia, and several other points.

BUSINESS BUILDINGS.

Notes Arranged Alphabetically by States.

**Mobile, Ala.*—The Southern Ry. Co., it is stated, has awarded the contract to erect the union passenger station in this city to the General Supply & Constr. Co., of N. Y. City, at about $500,000.

Ft. Smith, Ark.—It is stated that the Eagles have purchased a site at N. 6th and B. Sts. for the erection of a fraternal building, to cost about $35,000.

Long Beach, Cal.—C. R. Drake, Pres. Seaside Water Co., and others are reported to have in contemplation the erection of a hotel to cost $250,000.

Los Angeles, Cal.—M. A. Newmark & Co. are stated to have purchased a site, 100 x 200 ft., at Alameda and Banning Sts., for the erection of a brick warehouse, to cost about $70,000.

Denver, Colo.—A. Ayers will erect a stone and brick warehouse here, at a cost of $38,000.

**New Haven, Conn.*—A building permit has been issued for a 5-story warehouse, 50 x 237 ft., which is to be erected at Water and Wallace Sts., for Sargent & Co. Alex. McWilliam, carpenter; Baldwin Bros., masons.

Savannah, Ga.—It is stated that a clubhouse is to be erected by the Elks, at a cost of about $60,000.

Des Moines, Ia.—Proudfoot & Bird, Crocker Bldg., it is stated, are preparing plans for a 3-story business building which is to be erected by B. A. Younker and Morris Mandelbaum at W. 9th and Walnut Sts., at a cost of about $20,000.

C. C. Cross & Sons, Good Blk., are reported to be preparing plans for a 3-story brick business block, 128 x 90 ft., to be erected at 6th and High Sts., at a probable cost of $40,000.

Lewiston, Idaho.—The North Star Shoe store, in this city, is reported destroyed by fire.

**Sioux City, Ia.*—T. W. Chapman, of Waterloo, is stated to have secured the contract for erecting a telephone building at 411 7th St., for about $21,500.

Waterloo, Ia.—Plans are stated to have been prepared for a 2-story, 50 x 80 ft. brick block, to be erected at Saxon and E. 4th Sts., by Wm. Kurth.

Chicago, Ill.—Frost & Granger, 184 La Salle St., are reported to have awarded the contract for erecting the 5-story Hyde Park branch Y. M. C. A. building at 53d St. and Madison Ave., at a cost of $125,000.

Holabird & Roche, 1618 Monadnock Bldg., are reported to be preparing plans for a 4-story addition to the 8-story mercantile building at Michigan Ave. and Madison St., which was recently purchased by Chas. L. Willoughby.

It is stated that the 10-story Plymouth building at 303-305 Dearborn St., purchased by Robt. P. Lamont of the Simplex Railway Appliance Co., is to be enlarged 6 stories. The improvement will cost $150,000.

Plans for remodeling the 4-story building at 112-118 5th Ave., recently leased to Keane & Smedberg, into a 90-room hotel, are reported being prepared by Huehl & Schmid, 163 Randolph St.; improvement will cost $65,000.

The Chicago Junction Ry. (J. B. Cox, Ch. Engr.) will build a union freight station, 200x600 ft. ground dimensions, on West 43d St., along Loomis St., which will cost $45,000.

It is reported that the Michigan Central R. R. (R. H. L'Hommedieu, Gen. Mgr., Detroit, Mich.) will erect a 2-story freight house, 32x500 ft., at the foot of South Water St.; cost, $30,000.

Chicago, Ill.—See "Miscellaneous."

East St. Louis, Ill.—The Bell Telephone Co. is reported to be having plans prepared by Eames & Young of St. Louis, Mo., for a 3-story, 75 x 100-ft. brick exchange, to be erected at 8th St. and Missiouri Ave.; estimated cost, $75,000.

**Streator, Ill.*—G. A. Schmidt, of Streator, has received the contract to erect the Masonic Hall at $19,974. The contract for plumbing and heating is not yet awarded.

Huntington, Ind.—It is stated that the Bell Telephone Co. will expend $20,000 in reconstructing their building in Huntington.

Indianapolis, Ind.—The Indianapolis Building & Investment Co. is reported incorporated with a capital of $200,000, to erect a hotel at 136 to 144 S. Illinois St. by W. A. O'Brien for the erection of a residence for D.

**Indianapolis, Ind.*—John Pierce is stated to have secured the contract for erecting a building for the Knights of Pythias for $400,000.

The Trus. of the Henon Art Institute will soon receive bids, according to reports, for the construction of a new art building; estimated cost $80,000. The building will be of pressed brick and oolitic stone.

Muncie, Ind.—The plans of Alfred Grindle are stated to have been accepted for the terminal station, to be erected by the Indiana Union Traction Co. (Wm. C. Sampson, Secy.) at a cost of $45,000.

**Shelbyville, Ind.*—The contract for installing steam heating plant and plumbing the building for the I. O. O. F. is stated to have been awarded to F. B. Convery, of Shelbyville, for $2,250.

Shreveport, La.—Bids will be received until Oct. 7 (readvertisement) by Andrew Querbes, Pres. Bldg. Com., for furnishing material and erecting a 3-story brick, terra cotta and steel-framed building for the B. P. O. Elks, No. 122. Plans and specifications may be had by applying to A. J. Armstrong, archt., Shreveport.

**Items marked thus give the names of parties awarded contracts.*

Menominee, Mich.—It is stated that the Commercial Bank of Menominee will erect a bank building, to cost $16,000. According to reports contracts will be let at once.

St. Joseph, Mich.—It is stated that Vincent & Blake, of the Hotel Whitcomb, will erect a bath house to cost $30,000.

Little Falls, Minn.—The erection of an opera house here, to cost about $18,000 is reported under consideration. E. T. Davidson, of St. Cloud, may be able to give further information.

Winona, Minn.—It is stated that a Y. M. C. A. building will be erected here, at a probable cost of $40,000.

Kansas City, Mo.—Brick buildings, with stores, are to be erected in this city as follows: 114-126 E. 15th St., cost $26,000, owner S. C. Lee; 906-908 Baltimore Ave., cost $25,000, owner C. F. Etwein; 1013 and 1015 Main St., cost $30,000, owner L. W. Besse; 908 and 910 Grand Ave., cost $60,000, owner I. H. Beckham, architect C. A. Smith.

St. Louis, Mo.—It is stated that plans are completed for a 7-story building to be erected for Adolph Lopez, to cost $35,000. H. G. Clymer, Archt., Chestnut and 7th Sts.

Cape May, N. J.—F. J. Osterling, of Pittsburg, Pa., is reported to be preparing plans for a hotel for the Cape May Real Estate Co., to cost $500,000.

Hoboken, N. J.—See "Railroads."

**Cleveland, O.*—Skeel Bros., 63 Center St., is stated to have secured a contract for erecting a building for the Peerless Motor Car Co., for $20,000.

Tiffin, O.—Bacon & Huber, of Toledo, it is stated, are preparing plans for a $30,000 clubhouse and auditorium for the Junior Order of United American Mechanics.

Portland, Ore.—The Masonic Grand Lodge of Oregon is stated to have purchased a site for the erection of a masonic temple, to cost $25,000.

Bangor, Pa.—W. W. Bretherick, of Philadelphia, is stated to have invited estimates for a 4-story, 50 x 150-ft. hotel, to be erected at Bangor for Geo. Rodenbaugh.

Philadelphia, Pa.—It is stated that bids will be received about Sept. 1 for erecting a 142x143-ft. building at Broad and Chestnut Sts. for the Girard Trust Co., at a cost of $1,500,000. Allen Evans, of Philadelphia, and McKim, Mead & White, 160 5th Ave., New York, N. Y. archts.

**Philadelphia, Pa.*—Cramp & Co., 1421 Filbert St., it is stated, have received the contract to erect a store building on 15th and Chestnut Sts., at a cost of about $60,000.

*The Chas. McCaul Co., 10 N. 11th St., it is stated, has been granted a permit to erect a 2-story exchange, 65x96 ft., at Lancaster Ave. and Media St., for the Bell Telephone Co., the cost to be about $80,000.

*John Price, it is stated, has received the contract to erect a 4-story brick store building at 1630 Chestnut St. for Jules Junker, the cost to be $27,000.

Memphis, Tenn.—Chighizola, Hanker & Cairns, Scimitar Bldg., are reported to be preparing plans for a 3-story brick warehouse, to be erected at 2d and Gayoso Sts., for Geo. E. Witt, at a cost of $20,000.

Atchison, Tex.—Lodge No. 647, B. P. O. Elks, is about to erect a club house at a cost of $12,000. John R. Schmitt, Secy.

Richmond, Va.—Plans are stated to have been approved for a 2-story, 74 x 58 ft. parish house, to be erected at 22d and Venable Sts., for the congregation of Christ Episcopal Church.

**Seattle, Wash.*—Contracts for erecting and plumbing the Schwabacher building are stated to have been awarded to Alex Pearson and P. J. Glennon respectively. The structure to be 5 story, 75 x 134 ft., and of mill construction throughout.

Fond du Lac, Wis.—P. B. Haber & Hapolter are reported to have in contemplation the erection of an opera house, at a cost of $30,000.

Milwaukee, Wis.—It is stated that the Pabst Brewing Co. will erect a 3-story building at Grand Ave. and 3d St., at a cost of $33,000.

New York, N. Y.

127 Hester St., 6 story br. and stone store and tenemt.; c, $35,000; o, Alex. H. Pincus; a, Samuel Sass.

304 E. 8th St., 2 6-story br. store and tenemt.; total c, $66,000; o, Kramer & Rockmore; a, Geo. T. Pelham.

238 E. 20th St., 5-story br. and stone loft bldg.; c, $20,000; o, Mary C. O'Beirne; a, A. G. Koenig.

102 W. 46th St., 5-story br. and stone stable; c, $25,000; o, Robt. Taggart, Jr.; a, L. A. Goldstone.

50th St. and Park Ave., 2-story br. and stone substation; c, $130,000; o, New York Central & Hudson River R. R. Co.; a, C. A. Reed.

Bway. and 57th St., 4-story br. and stone garage; c, $40,000; o, Benj. Eichberg; a, Oscar Lowinson.

95th St. and 2d Ave., 6-story br. and stone store and tenemt.; c, $35,000; o, Abraham Jacobs; a, Horenburger & Straub.

113th St. and 2d Ave., 6-story br. and stone store and tenemt.; c, $50,000; o, Biagio Pernetti; a, L. T. J. Weiher.

127 E. 113th St., 6-story br. and stone store and tenemt.; c, $40,000; o, Feinberg, Watsky & Feinberg.

124 E. 123d St., 6-story br. and stone tenemt. and stores; c, $30,000; o, Benj. Berger; a, Geo. F. Pelham.

1685 1st Ave., 6-story br. and stone stores and tenemt.; c, $35,000; o, Nathan Kirsh; a, Horenburger & Straub.

2207 2d Ave., 6-story br. and stone store and tenemt.; c, $25,000; o, H. Kohn; a, M. Zipkes.

3d Ave. and 66th St., 5 6-story br. and stone tenemts. and stores; total c, $235,000; o, Hamilton Heights Syndicate; a, Geo. F. Pelham.

Amsterdam Ave. and 122d St., 2 6-story br. and stone stores and tenemts.; total c, $100,000; o, Lefkowitz & Horwitz; a, Geo. F. Pelham.

2,237 Bway., 5-story br. and stone stores and loft bldg.; c, $35,000; o, Andrew Craig; a, Wm. W. Howe.

Exterior and 192d St., 2-story br. sub-power station; c, $66,000; o, N. Y. C. & H. R. R. R. Co.; a, Reed & Stern.

St. Marys St. and Crimmins Ave., 2 5-story br. tenemts.; total c, $80,000; o, Rankin Bros., a, M. J. Garvin.

153d St. and Sheridan Ave., 2-story br. sub-power station; c, $58,000; o, N. Y. C. & H. R. R. R. Co.; a, Reed & Stern.

Webster Ave. and 198th St., 2-story br. sub-power station; c, $52,000; o, N. Y. C. & H. R. R. R. Co.; a, Reed & Stern.

Guelph, Ont.—It is stated that the Canadian Pacific Ry. (W. T. Tye, Ch. Engr., Montreal, Que.) will erect a station at Trafalgar Sq., near Eramosa Bridge, at a cost of $40,000.

CHURCHES AND DWELLINGS.

Notes Arranged Alphabetically by States.

Savannah, Ga.—It is reported that bids will be received until Aug. 23 for erecting a brick church at Bolton and W. Broad Sts. Address J. H. Hooker, 23 W. Boundary St.

Chicago, Ill.—It is stated that Norman P. Cummings will erect a 3-story brick apartment at Lake Ave. and 47th St., to cost $200,000.

Chas. A. Strandel, 131 La Salle St., is reported to be preparing plans for 2 flats, one to be 77 x 106 ft., erected at W. Polk St. and Spaulding Ave., and the other 50 x 106 ft., at Lexington St. and Spaulding Ave.; total cost $70,000.

It is reported that an apartment house will be erected at Lake Ave. and 50th St. for C. W. Hoff, at a cost of $100,000.

**Indianapolis, Ind.*—The contract for erecting the Cathedral for Congregation of St. Peter and Paul, Catholic Church, on Meridian St., is stated to have been awarded to Albert Von Spreckelson, for $109,445.

Chickasha, Ind. Ter.—It is stated that the Baptists have decided to erect an edifice to cost $20,000.

Sioux City, Ia.—The Congregation of the First Baptist Church is reported to have in contemplation the erection of an edifice to cost $45,000.

Louisville, Ky.—Mason Maury, Bd. of Trade Bldg., has prepared plans for the apartment house which is to be erected by a syndicate formed by Walter S. Adams, Real Estate Broker. Cost, $350,000.

Kansas City, Mo.—C. P. Batchelor will erect brick apartment house at 9th St. and Troost Ave., to cost about $85,000.

St. Louis, Mo.—A building permit has been issued for the 3-story brick residence which is to be erected for Chas. W. Nugent, at a cost of $40,000; also for a garage, to cost $7,000. Barnett, Haynes & Barnett, Olive and 9th Sts.

Butte, Mont.—Plans are stated to have been prepared by W. H. O'Brien for the erection of a residence for D. J. Hennessy, at a cost of $40,000.

**New York, N. Y.*—A. J. Robinson & Co., 123 E. 23d St., it is stated, have secured the contract to erect a temporary edifice for the congregation of St. Thomas' Church on the site of the structure which was recently destroyed by fire, the cost to be about $25,000.

It is reported to be the intention of the congregation of St. Thomas' Church to erect an edifice to cost about $500,000, to be completed by the end of 1906, on the site at 5th Ave. and 53d St., to replace the structure recently destroyed by fire.

Zanesville, O.—Badgley & Nicklas, 1273 Euclid Ave., Cleveland, are reported to be preparing plans for a 2-story, 135 x 140-ft. brick edifice. to be erected here for the congregation of Second M. E. Church, at a cost of $60,000. Rev. A. M. Courtney, Pastor.

Cleveland, O.—John Schmeller, Park Bldg., is stated to have received the contract for erecting the Jewish Synagogue at Willson and Scoville Ave., at an estimated cost of $50,000.

S. E. Dettelbach, Williamson Bldg., is reported to have prepared plans for an apartment building to be erected on the Boulevard, near Wade Park Ave. It will be a 4-story building, brick, with stone trimmings, hardwood finish, to cost about $25,000.

It is reported that the General Improvement Co., 314 Williamson Bldg., proposes to erect an apartment building on the Boulevard, between Euclid and Wade Park Ave. It will be a 4-story brick building; probably cost $30,000.

Toledo, O.—It is reported that plans are being prepared for a 3-story, 66 x 126 ft. cement and concrete apartment house, to be erected at Cherry and Sherman Sts., for Dr. W. A. Wright, at a cost of $25,000.

Harrisburg, Pa.—J. McKelvey, 1316 Bartine St., is stated to have received the contract for erecting a residence for P. Russ, at a cost of $20,000.

**Philadelphia, Pa.*—Wm. J. Gruhler, of Germantown, is reported to have received the contract for the erection of a $20,000 addition to the residence of Randal Morgan, of Chestnut Hill. The building will be 3 stories high, 24 x 44 ft.

J. E. & A. L. Pennock, Land Title Bldg., are stated to have received the contract for erecting a 3-story brick and stone residence on Queen Lane, near Wissahickon Ave., at a cost of about $100,000, for Clarence M. Clark. Horace W. Sellers, Archt.

Memphis, Tenn.—E. D. Patterson, Jr., is stated to have purchased a site for the erection of a flat to cost $200,000.

Dallas, Tex.—A permit is stated to have been issued to H. S. Schleine for the erection of a 2-story brick flat at Young and Akard Sts., at a cost of $22,000.

Seattle, Wash.—J. K. Dow, 518 Peyton Bldg., it is stated, is completing plans for an apartment house to be erected at Riverside Ave. and Maple St. for Levi W. Hutton, of Wallace, estimated to cost $50,000.

New York, N. Y.

83d St. and 1st Ave., 6-story br. and stone tenemt.; c, $50,000; o, Katz & Wimpie; a, Bernstein & Bernstein.

101st St. and 1st Ave., 3 6-story br. and stone tenemts.; total c, $121,000; o, H. Wilchinsky; a, Bernstein & Bernstein.

112th St. and Madison Ave., 2 6-story br. and stone tenemt.; total c, $80,000; o, Jacob Fish; a, Bernstein & Bernstein.

210 E. 113th St., 6-story br. and stone tenemt.; c, $45,000; o, Saml. Borowsky; a, Bernstein & Bernstein.

519 E. 117th St., 6-story br. and stone tenemt.; c, $45,000; o, Louis O. Cohen; a, Bernstein & Bernstein.

222 E. 119th St., 4 6-story br. and stone tenemts.; total c, $160,000; o, Huben Realty Co.; a, Bernstein & Bernstein.

Madison Ave. and 100th St., 6-story br. and stone tenemt.; c, $50,000; o, Shapiro & Shapiro; a, Bernstein & Bernstein.

2d Ave. and 78th St., 6-story br. and stone tenemt.; c, $50,000; o, Julius Weinstein; a, Bernstein & Bernstein.

122d St. and Amsterdam Ave., 2 6-stroy br. and stone tenemts.; total c, $76,000; o, Lefkowitz & Horwitz; a, Geo. F. Pelham.

150th St. and 8th Ave., 5-story br. and stone tenemts.; total c, $280,000; o, Miller & Mofensen; a, Bernstein & Bernstein.

176th St. and Amsterdam Ave., 4 5-story br. and stone tenemts.; total c, $160,000; o, Winslow Realty Co.; a, Hugo Kafpa & Sons.

Amsterdam Ave. and 167th St., 6-story br. and stone tenemt.; c, $50,000; o, Kleinfeld & Englesberg; a, Eugene J. Stern.

155th St. and Morris Ave. 2 6-story br. tenemts.; total c, $110,000; o, Isaac Loewenthal; a, Lorenz T. J. Weiher.

Beach Ave. and 152d St., 4 5-story br. tenemts.; total c, $160,000; o, Ignatz Floris Assoc.; a, Louis C. Maurer.

Forest Ave. and 160th St., 5-story br. tenemt.; c, $50,000; o, Max Sternberg; a, Goldner & Goldberg.

Jackson Ave. and 160th St., 5-story br. tenemt.; c, $50,000; o, Max Sternberg; a, Goldner & Sternberg.

St. Ann's Ave. and St. Mary's St., 5-story br. tenemt.; c, $40,000; o, Rankin Bros.; a, M. J. Garvin.

Washington Ave. and 166th St., 5-story br. tenemt.; c, $40,000; o, Jos. Hyman; a, Moore & Landsiedel.

Washington and Tremont Aves., 5-story br. tenemt.; c, $50,000; o, Sommer Constr. Co. a, C. A. Millner.

SCHOOLS.

Notes Arranged Alphabetically by States.

**Storrs, Conn.*—The H. Wales Lines Co., of Meriden, is reported to have secured the contract for erecting a dormitory for the Connecticut Agricultural College. The building to be 3-story brick and cost about $60,000.

**Athens, Ga.*—Geo. B. Heinman, of Atlanta, Ga., has received the contract to erect 2 buildings at the State Normal School (bids received Aug. 8). Cost, according to press reports, about $50,000. R. E. Davidson, Chmn. Bldg. Com.

Alton, Ill.—The Bd. of Educ. is reported to have decided to erect an addition to the Lincoln School.

**Elgin, Ill.*—Marckhoff Bros., of Elgin, are stated to have received the contract for erecting the addition to the high school on the west side for $17,093.

Evanston, Ill.—Phillips, Rogers & Woodyatt are stated to have prepared plans for a 2-story, 140 x 80-ft. school, to be erected in Evanston, at a cost of $55,000.

Hope, Ind.—The School Bd. (Dr. L. D. Reed, Secy.), it is stated, intends erecting a new high school, at a cost of about $20,000.

**Indianapolis, Ind.*—Julius M. Kaminsky & Co. are stated to have received the contract for installing a heating plant at School No. 18, for $2,291.

Cedar Falls, Ia.—Proudfoot & Bird, of Des Moines, are stated to have prepared plans for a 3-story, 66 x 160 ft. building, for the laboratory of the Indiana State Normal School.

Lyons, Ia.—Bids will be received until Sept. 2 by the Bd. Educ., Independent School Dist. of Lyons City (J. W. McPherson, Secy.) for erecting a High School. Temple, Burrows & McLane, Archts., 63 McManus Bldg., Davenport.

Lyons, Ia.—The plans of Burrows & McLane, of Davenport, are stated to have been approved for the 2-story, 112 x 80-ft. high school, to be erected in Lyons.

Holyoke, Mass.—See "Power Plants, Gas and Electricity."

**Reading, Mass.*—H. P. Cummings & Co., of Boston, it is stated, have secured the contract to erect the high school at $82,587.

St. Paul, Minn.—Thos. H. Shevlin is stated to have donated $60,000 toward the erection of a building for the State University.

The Bd. of Regents of State University is stated to have adopted plans for the ground floor of the main building, which is to cost $450,000.

Plans are stated to have been adopted for the administration building at the State Agricultural College, to cost $225,000.

Detroit, Mich.—Bids will be received until Aug. 22 by the Bd. Educ. (Wm. J. Lee, Secy.) for furnishing materials and erecting 2 15-room buildings, one, the Thomas, bounded by Canton, Ferry and Concord Ave., and the other the McKinstry, on McKinstry and McMillan Aves.

Durham, N. C.—Bids will be received until Aug. 31 by the Bd. Educ. for erecting a high school. Wheeler, Runge & Dickey, archts., Charlotte.

**Wahpeton, N. D.*—F. A. Hancock is stated to have received the contract for constructing the Indian schools at Wahpeton, N. D., for $60,450.

Englewood, N. J.—School bonds amounting to $75,000, it is stated, have been sold.

Orange, N. J.—It is reported that bids will be received until Aug. 30 by the Bd. Educ. for erecting the Central School at Main and Cleveland Sts.; probable cost, $125,000. Herbert D. Hale, archt., New York, N. Y.

**Salem, N. J.*—Jos. Steelman, of Bridgeton, it is stated, has received the contract to erect the brick high school at $22,600.

**New York, N. Y.*—The following are the bids opened on Aug. 14 by C. B. J. Snyder, Supt. School Bldgs., N. Y. City, for general construction, etc., of School 90, Manhattan Boro.: Buckley Realty Constr. Co., $473,000; Thos. Cockerill & Son, $468,900; Thos. B. Leahy Bldg. Co., $509,321; P. J. Brennan, $455,000; Chas. H. Peckworth, $482,521; Richard E. Heningham, $454,950; Geo. Hildebrand, $462,000; Attilio Pasquini, $548,640, and Walters & O'Connell, 100 Duane St., N. Y. City, $453,594 (awarded contract).

*Bids were opened same time and place for alterations, repairs, etc., to Hall of the Board of Educ., Manhattan Boro.: William Werner, $13,924, and Julius Haas, 767 Lexington Ave., N. Y. City, $13,647 (awarded contract).

*Bids were opened same time and place for the general construction, etc., of addition to and alterations in School No. 53, Boro. of Manhattan: Thos. Cockerill & Son, $44,900; Francis Sullivan, $37,475; Wm. Werner,

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**Items marked thus give the names of parties awarded contracts.*

$40,770; Geo. Hildebrand, $39,884; B. Gallagher, $43,740; Tolmie & Kerr, $38,637; Thomas McKeown, 267 W. 30th St., N. Y. City, $36,483 (awarded contract); Alfred Nugent's Son, $37,693; Edmund D. Broderick, $36,994; James Buckley, $49,590.

*Bids were opened same time and place for the general construction, etc., of temporary school buildings in rear of School 45, Boro. of Brooklyn: P. S. O'Brien, $34,637; F. J. Kelly's Sons, $31,913; John Auer & Son, $33,700; Wm. Werner, $33,877; Jos. Ohlhausen, $31,834; Chas. Meads & Co., 220 B'way, N. Y. City, $29,300 (awarded contract); Richard E. Heningham, $30,656; George Stanton, $31,760.

*Bids were opened same time and place for the general construction, etc., of School 1, Boro. of Richmond: Buckley Realty Constr. Co., $196,400; Geo. Hildebrand, 1004 B'way, N. Y. City, $179,400 (awarded contract); Thos. Cockerill & Son, $189,900; Chas. H. Peckworth, $185,908; Wm. Werner, $195,700.

*Bids were opened same time and place for installing ventilating and heating apparatus in temporary school No. 8 Boro. Manhattan, Dan'l J. Rice receiving the contract at $1,559.

Brooklyn, N. Y.—Bids will be received until Aug. 28 by C. B. J. Snyder, Supt. School Bldgs., New York City, for the general construction of 5-class room addition, etc., to School 41 (annex No. 2); installing, ventilating and heating apparatus in addition to and alterations in School 89; for the sanitary work and gas fitting of School 149, all in Boro. Brooklyn.

Binghamton, N. Y.—Bids for erecting *a* the Robinson St. School, *b* the addition to Clinton St. School, are stated to have been opened on Aug. 7, as follows: A. F. Shirley & Co., *a* and *b* $56,290; Clark Bldg. & Constr. Co., *b* $6,283; Tracey & Wm. Farley, *b* $6,450, *a* $56,450; McManamy & Rodman, plumbing and gas fitting, *a* and *b* $2,498; Runyon & Ogden, steam heating system in *a* $6,577, and T. J. Cronin, plumbing and gas fitting, in *a* $1,793.

Long Island City, L. I., N. Y.—Plans have been approved, according to reports for improvements to be made to the various schools in the Boro. of Queens, including an addition to the College Point School at 6th Ave. and 16th St., at a cost of $24,000, and a $10,000 addition to the Whitestone School.

Avondale, O.—E. H. Dornette, Pickering Bldg., Cincinnati, and E. N. Hannaford are stated to have completed plans for a 253 x 196-ft. brick school, to be erected at Reading Road and Rockdale Ave., at a cost of $160,000.

Cincinnati, O.—The Bldg. Com. of the Bd. Educ., it is stated, intends erecting a 6-story warehouse on the site of the old Gaines High School. Estimated cost, $15,000.

**Marion, O.*—Chas. V. Berry, of Mansfield, is stated to have secured the contract for erecting a school at Marion for $30,000.

Toledo, O.—Bids will be received until Sept. 7 by the Comr. of Indian Affairs, Dept. of the Interior, Washington, D. C., for furnishing material and erecting a brick laundry and water system at the Sac and Fox School, Iowa. For further information apply to Wm. G. Malin, Supt., Toledo.

Salem, Ore.—Bids will be received until Sept. 5 by the Comr. of Indian Affairs, Dept. of the Interior, Washington, D. C., for furnishing material and constructing 2 frame barns, with plumbing and electric light, a frame employes' quarters and a brick hospital, both with plumbing, steam heat and electric light, at the Salem School, Ore. For further information apply to Edwin L. Chalcraft, Chemawa, Ore.

New Castle, Pa.—A $35,000 dormitory is to be erected at the Western Pennsylvania Colored Industrial School in this city, according to the plans of the Pres., Rev. Geo. W. Kincaid.

Philadelphia, Pa.—The Property Com. of the Bd. of Education is stated to have opened bids Aug. 1 for rebuilding tower of the Central High School, at Broad and Green Sts., the 3 lowest bids being as follows: W. Christy & Son, $41,621; Stewart Contr. Co., $33,529, and Henderson & Co., $33,797. All bids have been rejected and new bids are to be received Aug. 22. A. F. Hammond, Secy.

Chilocco, Okla. Ter.—Bids will be received until Aug. 31 by the Comr. of Indian Affairs, Dept. of the Interior, Washington, D. C., for furnishing material and erecting a stone cottage, with plumbing, steam heat and electric light, at the Chilocco School. S. M. McCowan, Supt., Chilocco.

El Paso, Tex.—It is stated that $50,000 school bonds have been sold.

Ripley, W. Va.—Bids will be received until Aug. 22 by the Bd. Educ. of the Independent School Dist. (Holly G. Armstrong, Pres.) for $13,000 school building bonds.

Madison, Wis.—The citizens are stated to have voted to issue $250,000 bonds for the erection of the Central high school.

Platteville, Wis.—The plans of Ryan & DeGelleke, of Milwaukee, for a 3-story brick and stone normal school which is to be erected at Platteville have been accepted by the Normal Regents. Cost, $120,000.

West Allis, Wis.—Bids will be received until Aug. 22 by the Dist. Bd. of Joint School Dist. No. 5 of the village of W. Allis and Greenfield, for erecting a brick school on National Ave., W. Allis; H. D. Hill, Village Clk.

STREET CLEANING AND GARBAGE DISPOSAL.

Notes Arranged Alphabetically by States.

**Duluth, Minn.*—McLeod & Smith, of Duluth, have secured the contract to build a Decarie incinerator for Duluth.

Kansas City, Mo.—It is stated that the City Bd. of Health has ordered bids to be received for the removal of garbage.

NEW INDUSTRIAL PLANTS.

See also Business Buildings.

Stebbins Mfg. Co., Sturgis, Mich., is building a new plant, consisting of main building, 150 x 60 ft., and other smaller buildings. This company is in the market for 150 hp. steam plant.

The Kellogg-McCrum-Howell Co., New York, will rebuild its Blairsville, Pa., plant, recently destroyed by fire. New plant will consist of main building, 100 x 300 ft., warehouse about same size, and enameling rooms, 300 x 50 ft.

Outram & Wilson, Urbana, O., are contemplating replacing their grain elevator, which was recently burned. Gasoline and steam power will be used.

Dodd & Struthers, Des Moines, Ia., will add new machinery to their lighting rod plant.

Termaat & Monahan Co., Oshkosh, Wis., are enlarging their plant by the addition of a new foundry building and machine shop, and are in the market for new machinery.

Otto Taubert, St. Paul, Minn., will at once rebuild his tanning plant. The new building will be constructed of brick, concrete and iron and will measure 50 x 125 ft. New machinery will be installed.

Eldro Richardson, Baltimore, Md., is erecting a 4-story, 23 x 82 ft. addition to his brass foundry, to be used as brass finishing and pattern storage departments.

Midland Steel Co., Pittsburg, Pa., will build a large blast furnace plant at Midland, Pa. A large tonnage of structural shapes and plates will be required. Contractors for the plant are Wm. B. Scaife & Sons Co., Pittsburg, Pa.

Allen Knitting Co., Allen, Pa., is building an 80x24-ft. addition to its plant. A 15-h.p. steam engine will be installed.

Union Twist Drill Co., Athol, Mass., are preparing to erect a 1-story brick and iron building, measuring 60x180 ft.

Buffalo (N. Y.) Dry Dock Co. is preparing plans for the erection of a machine shop and warehouse to measure 120x60 ft., 20 ft. high; also a punch shop, measuring 110x150 ft., 20 ft. high. The machinery in both of these new shops will be operated by electricity.

The D. Wilcox Mfg. Co., Mechanicsburg, Pa., will build a 90-ft. addition to its present forging shop. New machinery will be installed.

The Toledo-Massillon Bridge Co., Toledo, O., is preparing plans for a new plant at Toledo.

Iowa Ice Co., Des Moines, Ia., will shortly install a 50-ton plant, with a number of small cold-storage rooms and a large storage house having a capacity of 4,000 tons.

The Youngstown (O.) Sheet & Tube Co. is preparing to build a Bessemer steel plant with two 10-ton converters; also blooming mill, billet mill, sheet bar mill and plate mill.

Sherman Envelope Co., Worcester, Mass., will shortly erect a 3-story, 210x55-ft. addition to its present plant. The new building will be equipped with automatic sprinklers and blower system for heating. Electric drives will be employed. Power plant will consist of 50-h.p. engine and 100-h.p. boiler.

The Lehi (Utah) Mill & Elevator Co. will build a flour mill having a capacity of 50 bbls. per day. Mill will be operated by a 35-h.p. electric motor. The officers of the company are Thos. Webb, Pres., J. M. Parry, Vice-Pres.

Worthington Wall Paper Co., St. Louis, Mo., has purchased a site for a large wall paper factory, according to local newspaper reports.

MISCELLANEOUS.

Notes Arranged Alphabetically by States.

Riverton, Ala.—Bids will be received until Sept. 15 by Maj. H. C. Newcomer, Corps Engrs., U. S. A., Chattanooga, Tenn., for canal excavation at Colbert and Bee Tree Shoals, near Riverton, Ala., amounting to about $320,000, as advertised in The Engineering Record.

Forrest City, Ark.—It is reported that bids will be received until Sept. 9 by the Co. Court (T. C. Merwin, Clk.) for the construction of a ditch or canal through Drainage Dist. No. 2 in St. Francis County, ditch to be about 2½ miles long, requiring the removal of about 29,000 cu. yds. of earth.

San Francisco, Cal.—The Great Northern Ry. (A. H. Hogeland, Ch. Engr., St. Paul, Minn.) it is stated, is planning to build a dock at Smith Cove and a concrete sea wall.

Tallahassee, Fla.—It is stated that the Bd. of Trus. of the International Improv. Fund will make surveys on a point on the St. Lucie River to determine the most practicable and best route for a drainage canal.

Honolulu, H. I.—The following are the bids received July 20 by 1st Lieut. J. R. Slattery, Corp Engrs., U. S. A., Honolulu, for dredging 1,532,853 cu. yds. mud and sand in Honolulu Harbor, Hawaii, the bid of the San Francisco Bridge Co. being recommended to the Chief of Engineers for acceptance (price given per cu. yd.): Marshall C. Harris, 5 Market St., San Francisco, Cal., 31 cts.; Hawaiian Dredging Co., Ltd., Honolulu, T. H., 26.5 cts.; San Francisco Bridge Co., 220 Market St., San Francisco, Cal., 24.87 cts.; Cotton Bros. & Co., Honolulu, T. H., 43 cts.; North American Dredging Co., 95 Market St., San Francisco, Cal., 25.9 cts.; Lord & Belser, Honolulu, T. H., 29 cts., and Pacific Coast Dredging & Reclamation Co., 34 cts.

South Bend, Ind.—The Western Union Telegraph Co. (B. J. Graybill, Mgr.) is reported to have decided to place its wires under ground.

Jeffersonville, Ind.—Geo. Holzbog, of Jeffersonville, it is stated, has an interest in iron mines in Hardin County, Ill., and will soon be in the market for an overhead tramway 3,000 ft. and a complete equipment for lifting 1,000 tons per day.

Chicago, Ill.—Fred. B. McLean, it is reported, has applied for a permit to build a promenade pier out into the lake at the foot of 31st St. for a distance of nearly a mile. It is proposed to construct a steel pier, 4,000 ft. long from 60 to 300 feet wide and 21 ft. above the surface of the water. To construct a ball room for 500 people, a theatre seating 3,000, a cafe, yacht club and an observatory.

Albion, Ind.—J. L. Henry, Co. Aud., writes that the report of the Drainage Comrs. on the dredging of Elkhart River, has not yet been submitted.

**New Orleans, La.*—Bids were opened Aug. 1 for levee work in Bossier and Plaquemines Parishes, the following, according to reports, being awarded: Plaquemine Parish, Lafourche Dist., La Reusette levee, M. Cullin, 16.74 cts. per cu. yd.; Bossier Parish, Bossier Dist., Willow Chute levee, Ogden Bros., 15.87 cts. per cu. yd.; Scopini levee, Mike Hunt, 19.75 cts. per cu. yd.

Bids were also opened same time and place by the Lafourche Basin Levee Dist. Bd. for the Star enlargement work in Plaquemine Parish, the bid of E. P. Brady at 22.5 cts. per cu. yd. being recommended for award.

Bids will be received until Sept. 9 by Lieut. Col. Clinton B. Sears for hire of dredge for improving Bayou Teche, La.

Boston, Mass.—Bids will be received until Sept. 9 by Mordecai T. Endicott, Ch. Bureau of Yards & Docks, Navy Dept., Washington, D. C., for a pile and timber pier at the Navy Yard, Boston.

It is stated that bids will be received until Aug. 24 by the Harbor and Land Comrs. for about 10,400 cu. yds. dredging from northwesterly point of Hussey Shoal, Nantucket Harbor; also same date for building extension to sea wall and jetties at Stoney Beach, Hull; about 290 lin. ft. of concrete sea wall and 100 lin. ft. of concrete spur jetties are to be built.

Grand Rapids, Mich.—The following are the bids received by Col. M. B. Adams, Corps Engrs., U. S. A., Grand Rapids, for dredging at Michigan City Harbor, Ind., approximately 115,000 cu. yds., (*a*) price per cu. yd. scow measure; (*b*) totals: Great Lakes Dredge & Dock Co., Chicago, Ill., *a* 10.9 cts., *b* $12,535; The Fitz Simons & Connell Co., Chicago, Ill., *a* 16 cts., *b* $18,400; Greiling Bros., Green Bay, Wis., *a* 16 cts., *b* $18,400, and Northern Dredge Co., Duluth, Minn., *a* 19 cts., *b* $21,850.

Detroit, Mich.—The following are the bids received Aug. 14 by Maj. Lansing H. Beach, Corps. Engrs., U. S. A., for dredging (*a*) Saginaw River, (*b*) Sebewaing River, (*c*) pile revetment in Sebewing River: Jas. Davidson, W. Bay City, Mich., *a* 25 cts.; Chas. B. Curtiss, Bay City, Mich., *b* 22 cts., *c* $2.50; The Murray Co., Saginaw, Mich., *b* 19.5 cts., *c* $2.00; Canal Constr. Co., Chicago, Ill., *a* 27.5 cts., *b* 23 cts.

**Ann Arbor, Mich.*—Timothy Fohey & Sons, of Ft. Wayne, Ind., it is stated, has secured the contract for the Pleasant Lake drain at $8.45 per rod. This drain will be about 4 miles long and will cost the taxpayers of Lima, Dexter and Sylvan Townships $10,859.

St. Paul, Minn.—The Park Bd. will request the Council to authorize a $75,000 bond issue to provide for the extensions to Como and Phalen Parks, the widening of Como Ave. Boule. from Rice St. to Western Ave. and the completion of the Mississippi River Boule. No. 2 from Watson St. to Ft. Snelling.

Billings, Mont.—Bids will be received until Sept. 5 at the office of the Engineer of the U. S. Reclamation Service, Billings, for furnishing 7,000 bbls. more or less of Portland cement f. o. b. cars, as advertised in The Engineering Record.

Mt. Holly, N. J.—It is stated that bids will be received until Aug. 24 by the Com. Co. Freeholders for constructing a retaining wall in the township of Burlington.

Hoboken, N. J.—See "Railroads."

Elizabeth, N. J.—The City Council is discussing ways and means of cleaning and purifying Elizabeth River. The cost of such improvement, if taken up, will be about $250,000. W. H. Luster, Jr., City Surveyor.

New York, N. Y.—Bids will be received until Sept. 12 by Col. W. R. Livermore, Corps Engrs., U. S. A., Army Bldg., for dredging in Hudson River; also same date for dredging in Rondout Harbor, both advertised in The Engineering Record.

Brooklyn, N. Y.—The following are the bids opened on Aug. 10 by the Comrs. of Parks, N. Y. City, for furnishing material and erecting an Ohio sandstone wall on concrete foundation along Prospect Park west from 5th St. to 15th St., Brooklyn Boro. (price given per lin. ft.): Wm. Bradley & Son, $15.44; P. J. Carlin Constr. Co., $14.98½; Thos. G. Carlin, $17.82; Cooper & Evans, $15.88; Chas. Cranford, $14.45; Bart Dunn, $16.42; Richard E. Heningham, $17.32; Northeastern Constr. Co., $16.14; Jas. C. Redmond, $16.45, and Thos. O'C. Sloane, $18.90.

Buffalo, N. Y.—The only bid received for Aug. 7 by Col. H. M. Adams, Corps Engrs., U. S. A., for building a concrete superstructure at the Inner Beacon of Maumee Bay Straight Channel Ranges, Ohio, was submitted by M. Rabbitt, of Toledo, O., at $13,436, and has been rejected.

Mayor Knight has signed the resolution adopted by the Common Council directing the Comr. of Pub. Wks. to enter into a contract for the deepening, widening and straightening of Buffalo River and Cazenovia Creek under a combination of Plan A and B for the abatement of the South Buffalo floods. Plans are to be prepared by the Comr. of Pub. Wks. and bids will soon be asked.

Wauseon, O.—Bids will be received until Aug. 23 by the Co. Comrs. (Geo. D. Newcomer, Chmn.) at Wauseon, for constructing a ditch known as Bean Creek Improvement and Branch No. 1. The ditch is about 106,870 cu. yds. in length, and will require the removal of about 286,974 cu. yds. of dredge work and 28,504 cu. yds. team work. The total cost, including the removing of drift wood and excavating and moving and replacing bridges, is estimated at about $36,760. John F. Hettinger, Engr.

Cleveland, O.—Bids will be received until Sept. 6 by the Bd. Co. Comrs. (Julius C. Dorn, Clk.) for constructing the Newburg and East Cleveland village culverts. Wm. H. Evers, engr., 237 The Arcade.

*Jos. David, Arcade Bldg., has secured the contract to improve Dover Ditches (bids opened Aug. 8) at about $5,000. Wm. H. Evers, Co. Surv.

**Columbus, O.*—D. Elmer Roberts, of Racine, Wis., has secured the contract to furnish 3,400 signs for buildings and 1,300 for posts, bids received July 31. Chas. H. Frank, Secy. Bd. Pub. Service.

Bids will be received until Sept. 1 by the State Bd. Pub. Wks. (Chas. E. Perkins, Ch. Engr.) for improving the Northern division of the Ohio & Erie Canal by excavating and dredging the channel of said canal, commencing at Cleveland; approximate estimate of material to be excavated and dredged, 200,000 cu. yds.

**Items marked thus give the names of parties awarded contracts.*

Cleveland, O.—The following are the bids opened on Aug. 4 by the Bd. of Pub. Service, for dredging Cuyahoga River: (*a*) price per cu. yd. for 800,000 cu. yds. excav., (*b*) totals including logging: Williams Bros. & Morse, *a* 16¾ cts.; *b* $134,450. Graves & Stephens, *a* 19.4 cts., *b* $155,500. Wm. Dowell, *a* 23.5 cts., *b* $188,750 and L. P. & J. A. Smith Co., *a* 24 cts., *b* $192,600.

Astoria, Ore.—Bids will be received until Aug. 29 (Maj. W. C. Langfitt, Corps Engrs., U. S. A., Lighthouse Engr., Portland) for repairing wharf at lighthouse depot, Astoria.

Panama.—Bids will be received until Sept. 13 by the Isthmian Canal Comn. (D. W. Ross, Purchasing Agt.) Washington, D. C., for furnishing machine tools, gasoline engine and accessories, gasoline reservoir, etc.

Pittsburg, Pa.—The following are the bids received Aug. 10 by Maj. Wm. L. Sibert, Corps Engrs., U. S. A., Pittsburg, for dredging the approach to Lock No. 6, Ohio River: (*a*) 18,000 to 50,000 cu. yds., per cu. yd.; (*b*) total for 18,000 cu. yds., and (*c*) total for 50,000 cu. yds.; Monongahela & Western Dredging Co., Pittsburg, Pa., *a* 19 cts., *b* $3,430, *c* $9,500, and The Ohio River Contract Co., Glen Osborne, Pa., *a* 24 cts., *b* $4,320, *c* $12,000.

Capt. W. Harry Brown, of Pittsburg, it is stated, has purchased about 20 acres of land, a large portion fronting on Chesapeake Bay, and it is reported intends constructing a dock.

Spearfish, S. D.—Bids will be received until Aug. 26 at the office of the Black Hills Traction Co. (Richd. B. Hughes, Gen. Mgr.) for constructing about 5½ miles of canal, about 9 miles from Spearfish, involving the excavation of approximately 100,000 cu. yds. of earth, 15,000 cu. yds. rock, the construction of 200 cu. yds. dry stone culverts, etc.

Coleman, Tex.—Bids will be received until Aug. 25 by F. M. Bowen, Mayor, for constructing a concrete dam on Hord's Creek, near this city; John B. Hawley, Engr., Ft. Worth.

Norfolk, Va.—The following are the bids received on Aug. 11 by Capt. E. Eveleth Winslow, Corps Engrs., U. S. A., for dredging in Pagan River, Va.: L. M. Lewis, Berkley, Va., 10 cts.; John L. Grim, Philadelphia, Pa., 23 cts.; Norfolk Dredging Co., Norfolk, 12.3 cts., and Coastwise Dredging Co., Norfolk, 14.8 cts.

Harrisville, W. Va. — Bids will be received by H. Marsh, of Harrisville, for the purchase of $12,000 5 per cent. 20-year bonds, as advertised in The Engineering Record.

Caracas, Venezuela, S. A.—It is reported that Congress has voted estimates amounting to $11,000,000, including $900,000 for public works.

PROPOSALS OPEN

Proposals see pages 56, 60, 61, 63, 64 AND 65.

WATER WORKS.

Bids Close.		See Eng. Record.
Aug. 22.	Water-wks. Arlington, Neb.	Aug. 12
Aug. 22.	C. i. pipe, Chicago, Ill.	Aug. 12
Aug. 22.	Pumps, Thief River Falls, Minn.	Aug. 12
Aug. 22.	Mains, Detroit City, Minn.	Aug. 19
Aug. 22.	Reservoir, Marion, Ind.	Aug. 19
Aug. 22.	Pumping engine, Edmonton, Alta.	Aug. 19
Aug. 24.	System, Marksville, La. Adv. Aug. 5.	Jul. 29
Aug. 24.	System, Enderlin, N. D.	Aug. 19
Aug. 25.	Pipe, etc., Panama Adv. Jul. 29 to Aug. 19.	Jul. 29
Aug. 25.	Water-wks., Fredericktown, O. Adv. Aug. 12, 19.	Aug. 12
Aug. 25.	Stand pipe, Grand Rapids, Mich. Adv. Aug. 19.	Aug. 19
Aug. 25.	Dam, Greenwich, Conn. Adv. Aug. 19.	Aug. 19
Aug. 26.	Reservoir, Ft. Moultrie, S. C.	Jul. 29
Aug. 26.	Boiler, Ft. Ringgold, Tex.	Jul. 29
Aug. 26.	Well, etc., Woodville, Pa.	Aug. 19
Aug. 26.	Mains, etc., Bradley, Ill.	Aug. 19
Aug. 28.	Canal, etc., Montrose, Colo. Adv. Jul. 15 to Aug. 5.	
Aug. 28.	Pumping plant, Winnipeg, Man. Adv. Aug. 5.	Aug. 5
Aug. 28.	Water-wks., Monroe, Ga. Adv. Aug. 12, 19.	Aug. 12
Aug. 28.	Plant, Plymouth, O.	Aug. 19
Aug. 29.	Pipe, etc., Cincinnati, O.	Aug. 12
Aug. 29.	Mains, Marion, Ind.	Aug. 19
Aug. 30.	Engine, Perth Amboy, N. J. Adv. Aug. 19.	Aug. 19
Aug. 31.	Water-wks., Owensboro, Ky.	Aug. 12
Aug. 31.	Improv., Salt Lake City, Utah	Aug. 19
Aug. 31.	Water Wks., Banff, Alta.	Aug. 19
Aug. —.	Improv., Donalsonville, La.	Jul. 15
Sep. 1.	Water works, Barnesville, Minn.	Aug. 19
Sep. 2.	Pumping unit, Niagara Falls, Ont. Adv. Aug. 5, 12.	Aug. 5
Sep. 2.	Boiler, Ft. Brown, Tex.	Aug. 12
Sep. 2.	Chimney, Erie, Pa.	Aug. 12
Sep. 4.	Conduit, Salt Lake City, Utah Adv. Aug. 12, 19.	Aug. 12
Sep. 4.	Reservoir, Wilmington, Del. Adv. Aug. 12, 19.	Aug. 12
Sep. 4.	Mains, reservoir, etc., Ames, Ia. Adv. Aug. 19.	Aug. 19
Sept. 5.	Dam, etc., Cody, Wyo. Adv. Jul. 15 to Aug. 5.	Jul. 15
Sep. 5.	Standpipe, Stromsburg, Neb.	Aug. 12
Sep. 5.	Irrig. Canal, Turlock, Cal.	Aug. 19
Sept. 5.	Conduit, etc., Richmond, Va.	Aug. 19
Sep. 6.	Tunnel, etc., Cody, Wyo. Adv. Jul. 15 to Aug. 5.	Jul. 15
Sept. 6.	Collectors, etc., Philadelphia, Pa. Adv. Aug. 19.	Aug. 19
Sep. 7.	Conduit, Toledo, O.	Aug. 12
Sep. 7.	System at school, Toledo, O.	Aug. 12
Sept. 7.	Mains, Norfolk, Neb.	Aug. 19
Sept. 11.	Well, Ft. Hancock, N. J.	Aug. 19
Sep. 13.	System, Southern Pines, N. C.	Aug. 19
Sep. 14.	Pumping machinery, Columbus, O. Adv. Aug. 5 to 19.	Aug. 5
Sept. 18.	C. I. Pipe, Victoria, B. C.	Aug. 19
Sep. 19.	Pumps, etc., Toronto, Ont. Adv. Aug. 5 to 19.	Aug. 5
Sep. 26.	Tunnel, Montrose, Colo. Adv. Aug. 12, 19.	Aug. 12
Sep. —.	Water Wks., E. Grand Forks, Minn.	Aug. 19
Sep. —.	Water works, Jackson, Mo.	Aug. 19
Oct. 12.	Sale of standpipe, Attleboro, Mass. Adv. Jul. 29 to Aug. 5.	Jul. 29
————	Water wks. or franchise, Muncie, Ind. Adv. Jul. 29.	Jul. 29

SEWERAGE AND SEWAGE DISPOSAL.

Aug. 22.	Portland, Me.	Aug. 12
Aug. 22.	Downers Grove, Ill.	Aug. 19
Aug. 23.	Chicago, Ill. Adv. Jul. 29 to Aug. 12.	Jul. 29
Aug. 23.	Portland, Me.	Aug. 12
Aug. 23.	Des Moines, Ia.	Aug. 12
Aug. 24.	Clinton, Ia.	Jul. 29
Aug. 24.	Trenton, N. J.	Aug. 19
Aug. 25.	Rockford, Ill. Adv. Aug. 12.	Aug. 12
Aug. 25.	Hammond, Ind.	Aug. 19
Aug. 28.	Ames, Ia. Adv. Aug. 12.	Aug. 12
Aug. 28.	Winona, Minn.	Aug. 19
Aug. 28.	New York, N. Y.	Aug. 19
Aug. 28.	Port Chester, O.	Aug. 19
Aug. 28.	New Brunswick, N. J.	Aug. 19
Aug. 29.	Cleveland, O.	Aug. 19
Aug. 29.	Watertown, Wis.	Aug. 19
Aug. 31.	Chicago, Ill.	Aug. 19
Aug. 31.	Banff, Alta.	Aug. 19
Sep. 1.	Kenton, O.	Aug. 5
Sep. 1.	South Bend, Ind.	Aug. 12
Sep. 1.	Roanoke, Va.	Aug. 19
Sep. 2.	Newton, N. J. Adv. Aug. 12, 19.	Aug. 12
Sep. 5.	Harrison, N. J.	Aug. 12
Sept. 11.	Willoughby, O.	Aug. 19
Sept. 19.	Southern Pines, N. C.	Aug. 19

BRIDGES.

Aug. 21.	Gloucester, Mass.	Aug. 19
Aug. 21.	Titusville, Pa.	Aug. 19
Aug. 23.	Chicago, Ill.	Aug. 19
Aug. 24.	Brooklyn, N. Y.	Aug. 19
Aug. 24.	Marietta, O.	Aug. 19
Aug. 24.	Florence, N. J.	Aug. 19
Aug. 26.	Dayton, O.	Aug. 12
Aug. 28.	Woodward, Okla. Ter.	Aug. 19
Aug. 29.	Zanesville, O.	Aug. 19
Sep. 2.	Norristown, Pa.	Aug. 12
Sep. 4.	Mandan, N. D.	Aug. 12
Sep. 5.	Columbus, O.	Aug. 12
Sept. 8.	Virginia City, Mont.	Jul. 22
Sep. 30.	San Juan, P. R.	Aug. 5
Oct. 1.	Pensacola, Fla.	Aug. 12
Oct. 4.	Superstructure, Chicago, Ill.	Aug. 12
Oct. 4.	Substructure, Chicago, Ill.	Aug. 12

PAVING AND ROADMAKING.

Aug. 21.	Uniontown, Pa.	Aug. 19
Aug. 21.	Hartland, Conn.	Aug. 19
Aug. 21.	Tuckahoe, N. Y.	Aug. 19
Aug. 22.	Alliance, O.	Aug. 5
Aug. 22.	Upper Marlboro, Md.	Aug. 12
Aug. 22.	Bedford, Ind.	Aug. 12
Aug. 22.	Cincinnati, O.	Aug. 12
Aug. 22.	Chattanooga, Tenn.	Aug. 19
Aug. 23.	Madisonville, O.	Aug. 5
Aug. 23.	Chicago, Ill.	Aug. 19
Aug. 23.	Ottawa, Kan.	Aug. 19
Aug. 23.	Marion, O.	Aug. 19
Aug. 24.	Brooklyn, N. Y.	Aug. 19
Aug. 24.	Chicago, Ill.	Aug. 19
Aug. 25.	Elgin, Ill. Adv. Aug. 19.	Aug. 19
Aug. 28.	Asphalt plant, New Orleans, La. Adv. Jul. 29 to Aug. 19.	Jul. 29
Aug. 28.	Detroit, Mich.	Aug. 19
Aug. 28.	Louisville, Ky.	Aug. 19
Aug. 28.	Long Island City, L. I., N. Y.	Aug. 19
Aug. 29.	Portsmouth, O.	Aug. 12
Aug. 29.	Cleveland Heights, O.	Aug. 12
Aug. 29.	Portsmouth, O. Adv. Aug. 19.	Aug. 19
Aug. 29.	Zanesville, O.	Aug. 19
Aug. 29.	New Castle, Del.	Aug. 19
Aug. 29.	Troy, N. Y.	Aug. 19
Aug. 30.	Madison, Wis.	Aug. 12
Aug. 30.	Marion, O.	Aug. 19
Sep. 1.	Ft. Hancock, N. J.	Aug. 12
Sep. 1.	Wallace, Idaho	Aug. 12
Sep. 1.	Elizabeth, N. J.	Aug. 19
Sep. 5.	Norwalk, O.	Aug. 5
Sep. 5.	Harrison, N. J.	Aug. 12
Sep. 5.	Columbus, O.	Aug. 12
Sep. 5.	Cincinnati, O.	Aug. 12
Sep. 6.	Cincinnati, O.	Aug. 19
Sept. 10.	Shelbina, Mo.	Aug. 19
Sept. 11.	Janesville, Wis.	Aug. 19
Sept. 15.	Cincinnati, O.	Aug. 19

POWER, GAS AND ELECTRICITY.

Aug. 22.	Supplies, Washington, D. C.	Aug. 12
Aug. 23.	Burlington, Vt.	Aug. 12
Aug. 24.	Fort Wayne, Ind.	Jul. 8
Aug. 24.	Marksville, La. Adv. Aug. 5.	Jul. 29
Aug. 26.	Stoughton, Wis.	Aug. 19
Aug. 28.	Washington, D. C. Adv. Jul. 29 to Aug. 12.	Jul. 29
Aug. 28.	Winnipeg, Man. Adv. Aug. 5 to 19.	Aug. 5
Aug. 28.	Florence, S. C.	Aug. 12
Aug. 28.	Plymouth, O.	Aug. 19
Aug. 29.	Supplies, Pensacola, Fla.	Aug. 12
Aug. 29.	Boilers, etc., Washington, D. C.	Aug. 12
Aug. —.	Waukegan, Ill.	Jul. 29
Sep. 5.	Supplies, Washington, D. C.	Aug. 12
Sep. 5.	La Grange, Ga. Adv. Aug. 19.	Aug. 19
Sep. 6.	Ukiah, Cal.	Aug. 5
Sep. 30.	Washington, D. C. Adv. Aug. 5.	Aug. 5
Oct. 1.	**Tacoma, Wash.**	**Jul. 8**
Oct. 11.	Lockport, Ill.	Aug. 19
Dec. 2.	San Juan, Porto Rico	Aug. 19

BUILDINGS.

Aug. 22.	School, Santa Fe, N. M.	Jul. 29
Aug. 22.	School, Kosciusko, Miss.	Aug. 12
Aug. 22.	Pub. Bldg., Winnipeg, Man.	Aug. 19
Aug. 22.	Schools, Detroit, Mich.	Aug. 19
Aug. 22.	School, W. Allis, Wis.	Aug. 19
Aug. 22.	School, Philadelphia, Pa.	Aug. 19
Aug. 23.	Hospital, Philadelphia, Pa.	Aug. 12
Aug. 23.	Plmbg., etc., Police Court, New York, N. Y.	Aug. 19
Aug. 24.	Htg. P. O. bldg., Lincoln, Neb. Adv. Aug. 5, 12.	Aug. 5
Aug. 24.	Post bldgs., Ft. Wm. H. Seward, Alaska	Aug. 5
Aug. 24.	Hospital, Ft. Washington, Md. Adv. Aug. 12, 19.	Aug. 12
Aug. 24.	Hospital, Sandusky, O.	Aug. 12
Aug. 25.	School, La Moure, N. D.	Jul. 29
Aug. 25.	Post bldgs., Ft. Flagler, Wash.	Aug. 12
Aug. 26.	Htg. hotel, Cincinnati, O.	Jul. 22
Aug. 26.	Court house, Franklinton, La.	Aug. 5
Aug. 26.	Hospital, Grand Rapids, Mich.	Aug. 19
Aug. 26.	Hotel, Monmouth, Ill.	Aug. 19
Aug. 28.	Hospital bldgs., Buffalo, N. Y.	Jul. 29
Aug. 28.	Post bldgs., Ft. DuPont, Del. Adv. Aug. 5 to 19.	Aug. 5
Aug. 28.	Hospital, Terrell, Tex.	Aug. 19
Aug. 28.	Jail, Stephenville, Tex.	Aug. 19
Aug. 28.	Schools, Brooklyn, N. Y.	Aug. 19
Aug. 29.	School addition, Lakewood, O.	Aug. 5
Aug. 30.	School, Orange, N. J.	Aug. 19
Aug. 30.	Hospital, Ellis Island, N. Y. Harbor	Aug. 19
Aug. 31.	School, Durham, N. C.	Aug. 19
Aug. 31.	School, Chilocco, Okla. Ter.	Aug. 19
Aug. 31.	Htg. P. O., Burlington, Vt.	Aug. 19
Sep. 1.	City hall, plans, Regina, N. W. Ter.	Aug. 5
Sep. 1.	School, Detroit, Mich.	Aug. 12
Sep. 1.	Pub. bldg., La Crosse, Wis.	Aug. 12
Sep. 2.	School, Lyons, Ia.	Aug. 19
Sep. 4.	Htg., etc., courthouse, Huntington, Ind.	Jul. 29
Sep. 4.	Hospital, Little Rock, Ark.	Aug. 12
Sep. 5.	School, Salem, Ore.	Aug. 19
Sep. 7.	Hospital, Jersey City, N. J.	Aug. 12
Sep. 7.	School, Toledo, O.	Aug. 19
Sept. 8.	Hospital, Whipple Barracks, Ariz. Adv. Aug. 19.	Aug. 19
Sep. 9.	Pub. bldg., Philadelphia, Pa.	Aug. 12
Sept. 11.	Post Bldgs., San Francisco, Cal.	Aug. 19
Sep. 13.	Pub. Bldgs., Baltimore, Md.	Aug. 19
Sep. 14.	Bus. bldg., St. Louis, Mo.	Aug. 5
Sep. 14.	Lighthouse, Ft. Schuyler, N. Y. Adv. Aug. 12, 19.	Aug. 12
Sept. 19.	Capitol, Bismark, N. D.	Aug. 19
Sept. 20.	Court House, Akron, O.	Aug. 19
Sep. 30.	Htg., etc., pub. bldg., Washington, D. C. Adv. Aug. 5 to 19	Aug. 5
Oct. 5.	Courthouse, Manhattan, Kan.	Aug. 12

MISCELLANEOUS.

Aug. 22.	Drills, etc., Panama Adv. Jul. 22 to Aug. 19.	Jul. 22
Aug. 22.	Supplies, Washington, D. C.	Aug. 12
Aug. 22.	Elevator, Washington, D. C.	Aug. 12
Aug. 22.	Stone, Philadelphia, Pa.	Aug. 12
Aug. 23	Elevator, New York, N. Y.	Aug. 12
Aug. 23.	Garb. disposal, Philadelphia, Pa.	Aug. 12
Aug. 23.	Ditch, Wauseon, O.	Aug. 19
Aug. 24.	Breakwater, Boston, Mass.	Aug. 12
Aug. 24.	Dredging, Boston, Mass.	Aug. 19
Aug. 24.	Sea wall, Boston, Mass.	Aug. 19
Aug. 24.	Retain. wall, Mt. Holly, N. J.	Aug. 19
Aug. 25.	Dam, Coleman, Tex.	Aug. 19
Aug. 26.	Coal plant, Olongapo, P. I.	May 6
Aug. 26.	Filling etc., Key West, Fla.	Jul. 22
Aug. 26.	Dredging, New London, Conn. Adv. Aug. 5 to 19.	Aug. 5
Aug. 26.	Scales, Portsmouth, N. H.	Aug. 12
Aug. 26.	Canal, Spearfish, S. D.	Aug. 19
Aug. 26.	R. R. work, Stockdale, Tex.	Aug. 19
Aug. 28.	Sanitary fixtures, Panama	Aug. 5
Aug. 28.	R. R. work, Portage la Prairie, Man.	Aug. 12
Aug. 29.	Machines, etc., San Francisco, Cal.	Jul. 29
Aug. 29.	Supplies, Pensacola, Fla.	Aug. 12
Aug. 29.	Wharf, Astoria, Ore.	Aug. 19
Aug. 30.	Breakwater, Newport, R. I. Adv. Aug. 5 to 19.	Aug. 5
Aug. 31.	Lock and dam, Nashville, Tenn. Adv. Aug. 5 to 19.	Aug. 5
Aug. 31.	Dredging, Portland, Me. Adv. Aug. 5 to 19.	Aug. 5
Sep. 1.	Steel and iron, Sydney, N. S. Wales **Adv. Apr. 8, 22; May 6, 20; Jun. 3, 17.** Adv. Jul. 1, 15.	Apr. 8
Sep. 1.	Crane, Augusta, Ga.	Jul. 29
Sep. 1.	Garbage disposal, Chicago, Ill.	Aug. 12
Sep. 1.	R. R. Work, Purcell, Ind. Ter.	Aug. 19
Sept. 1.	Dredging, Columbus, O.	Aug. 19
Sep. 5.	Dredging, Oakland, Cal. Adv. Aug. 5 to 19.	Aug. 5
Sep. 5.	Supplies, Washington, D. C.	Aug. 12
Sep. 5.	Dredging, Mobile, Ala. Adv. Aug. 12 to 19.	Aug. 12
Sep. 5.	Canal, Miami, Fla. Adv. Aug. 12, 19.	Aug. 12
Sept. 5.	Cement, Billings, Mont. Adv. Aug. 19.	Aug. 19
Sep. 6.	Breakwater, Petoskey, Mich. Adv. Aug. 12, 19.	Aug. 12
Sep. 6.	Culverts, Cleveland, O.	Aug. 19
Sep. 7.	Dredging, New York, N. Y. Adv. Aug. 12, 19.	Aug. 12
Sep. 8.	Dredge pumps, etc., St. Louis, Mo. Adv. Aug. 12, 19.	Aug. 12
Sep. 9.	R. R. work, Miami, Fla. Adv. Jul. 15 to Aug. 19.	Jul. 29
Sep. 9.	Derrick, Guantanamo, Cuba	Aug. 12
Sep. 9.	Dredging, Charleston, S. C. Adv. Aug. 12, 19.	Aug. 12
Sep. 9.	Canal, Forrest City, Ark.	Aug. 19
Sep. 9.	Pier Boston Mass.	Aug. 19
Sept. 9.	Dredge, New Orleans, La.	Aug. 19
Sep. 12.	Crane, San Francisco, Cal.	Aug. 12
Sep. 12.	Machine tools, etc., New Orleans, La.	Aug. 12
Sep. 12.	Dredging, New York, N. Y. (2 prop.) Adv. Aug. 19.	Aug. 19
Sep. 13.	Machine tools, etc., Panama	Aug. 19
Sep. 15.	Excav. canal, Riverton, Ala. Adv. Aug. 19.	Aug. 19
Sep. 16.	Hoist, New York, N. Y.	Aug. 12
Nov. 1.	**R. R. work, Manila, P. I.** Adv. Jul. 29.	**Jun. 17**
Nov. 9.	Wharf, etc., Havana, Cuba	Jul. 29
Jan. 1.	Statue plans, Indianapolis, Ind.	Jul. 22
Apr. 2, '06.	**Harbor Work, Valparaiso, Chili,** Adv. Apr. 29 to Aug. 19.	**Apr. 29**
————	R. R. work, Trinity, Tex.	Aug. 12

**Items marked thus give the names of parties awarded contracts.*